

GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS



REPORT
OF
THE EXPERT COMMITTEE
ON
COAL CONSUMPTION ON RAILWAYS
1958

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PREFACE

The steam locomotive has been and will remain for many years to come the mainstay of rail transport in India. At present, Railways use nearly a third of the country's coal out-put, and coal is the largest single item of railway expenditure. In the context of low reserves of high-grade coal in the country and of the dire necessity for economy in expenditure, coal consumption and the mounting fuel bill of Railways have been constantly in the public eye.

From time to time, different aspects of the coal problem, such as its reserves, production and distribution; its grading and pricing; the scope for economy in consumption etc. have been examined by various Committees. In the recent past, the Fuel Economy Enquiry Committee 1953 (Shri D. C. Driver, Chairman) focussed attention on the irrational distribution and price structure of coal, and on the effect of inferior coal supplies on rail transport and expenditure. The Coal Washeries Committee, 1954 (Shri J. N. Mukherji, Chairman) reported on the feasibility of setting up washeries to improve the quality of inferior coals, which are in abundant supply in the country.

In spite of the commendable work done by these Committees, and the efforts made by Railways, the Railway fuel bill continues to rise. Public concern on this matter was again voiced in the Lok Sabha in August 1957. The Hon'ble Minister for Railways therefore decided to have the whole question examined and on the 9th August 1957 he gave the following assurance :

"I think a small Committee is necessary to go into this question as to how the increase is due to the quality of coal or whether there is any extra expenditure in handling the coal... I propose to have this question examined in greater detail."

Accordingly, the present Committee, designated as the 'Expert Committee on Coal Consumption on Railways', was appointed in November 1957. As the Railway Board were already considering the appointment of a Committee to assess the future requirements of Railway coal and the prospects of supplies, the terms of reference were enlarged to include this issue.

In addition to the analysis of expenditure and the examination of future supplies, the Committee have attempted to make a quantitative assessment of the factors responsible for increase in consumption of coal, and to indicate the directions in which economy can be achieved. Apart from the need for effective control on coal consumption by Railways, there is room for considerable economy by improving quality of coal supplies. The Committee have therefore emphasised the need for improving the quality of coal supplies to Railways by giving them freedom to select collieries, and by setting up a Railway Inspection Organisation at the loading points in the coalfields.

With regard to the dearth of high-grade coals for Railway use, the Committee are of the view that the setting up of washeries for upgrading inferior coals, of which supplies are abundant, is inevitable.

KARNAIL SINGH

Chairman,

Expert Committee on Coal Consumption.

INTRODUCTION

The Expert Committee on Coal Consumption on Railways was appointed by the Ministry of Railways under their letter No. E57COI/133 RB1, dated the 5th November, 1957, Appendix 1 (a), to study the Railway coal problem in accordance with the following terms of reference :—

- I. To examine and to report on the factors responsible for increase in railway expenditure on coal, commenting particularly on—
 - (i) the extent to which the quality of coal is responsible for increase in consumption and expenditure and for poor performance ;
 - (ii) the expenditure incurred on handling charges keeping in view the lead and lift involved ;
 - (iii) the comparative merits and demerits of employing departmental or contract labour for coal handling ;
 - (iv) the causes and quantum of wastage and losses of coal in transit, in sheds and otherwise ;
 - (v) the extent to which the increase in expenditure on coal is due to increase in traffic, coal prices, freight charges on coal, etc.
- II. To examine the Railways' future requirements of high grade coal for steam traction and the prospects of adequate supplies and to recommend measure for meeting any anticipated shortages.

Constitution of the Committee

The Committee was constituted as follows :—

1. Shri Karnail Singh, Member, Engineering,
Railway Board. *Chairman*
2. Shri R. Krishnaswamy, Director, Mechanical Engineering
Railway Board. *Member*
3. Shri Ratan Lall, Director, Transportation (T), Railway
Board. *Member*
4. Dr. J. W. Whitaker, Dy. Director General, Council
of Scientific and Industrial Research, New Delhi. . . *Member*
5. Shri P. M. Nayak, I.C.S., Coal Controller, Calcutta. . . *Member*
6. Shri D. P. Mathur, Senior Dy. General Manager,
Central Railway, Bombay. *Member—
Secretary*

Joint Director, Mechanical Engineering (Ccal), Railway Board (Shri M. V. Kam'ani), to give technical assistance to the Secretary.

Dr. A. Lahari, Director, Fuel Research Institute, Dhanbad, was later appointed as a Member of the Committee from 8th February, 1958.

The Committee commenced their work on 16-11-1957 when Shri D. P. Mathur assumed charge as Member-Secretary at New Delhi. A Questionnaire [Appendix 1 (b)], relating to the different issues contained in the terms of reference was circulated on 27-11-1957 to the Railways, the Coal Controller and the Director, Geological Survey of India, etc., for collecting information. Supplements to the Questionnaire were also issued from time to time. Replies to the Questionnaire and supplementary enquiries were received in parts and their examination was completed by the end of April, 1958.

Approach to the Enquiry

Regarding the first term of reference, relating to factors responsible for increase in Railways' expenditure on coal, the Committee conducted the following field investigations on Railways which continued upto the end of May 1958

- (a) Test weighments of coal wagons at colliery base stations to see whether the wagons were correctly loaded at the sources of supply.
- (b) Test weighment of wagons received at Loco sheds to see what losses of coal take place in transit.
- (c) Coal trials with two Fuel Test Car Units to determine actual consumption of coal on various services as compared with the trip rations and the consumption recorded in sheds on the same services operated by the same locomotives, with a view to assess the extent of wastages and losses.
- (d) 'Rapid Quality Surveys' on Railways for an assessment of the quality of coal received by them.

The Member-Secretary, assisted by the Joint Director, Mechanical Engineering (Coal), also studied the system of control exercised in loco sheds for prevention of wastages of coal on shed services and train operation.

Plan of the Report

The Report is divided into two parts. Part I deals with the examination of the first term of reference. The first chapter in this part is an outline of the study on '*Grading and Pricing of Indian Coals*' and has been given as a prelude for a proper appreciation of the various issues covered by the terms of reference.

Part II of the Report deals with the problem of the future supplies of high grade coals to Railways, anticipated deficiencies, and the measures necessary to improve the supplies.

A Résumé of the Report together with a Summary of the Recommendations is given at the end of Part II of the Report.

CHAPTER 1

INDIAN COALS : GRADING AND PRICE STRUCTURE

For a proper appreciation of the various issues connected with the terms of reference, it is necessary to review briefly the types and the grades of Indian coals, the price structure introduced under Government control and the effect of the price structure on fuel costs to the consumers, particularly to the Railways.

Types of Coal.

2. Coals in India are obtained (i) from Bengal & Bihar Coalfields comprising Jharia, Raniganj, Bokaro and Karanpura coal-bearing areas and (ii) from the Outlying Coalfields located in Madhya Pradesh (Korea, Chindwara, Korba, etc.), Bombay (Chanda), Andhra Pradesh (Singareni), Orissa (Talcher), and Assam (Khasi, Jaintia and Garo hills, etc.). In addition, lignite (*i.e.* brown coal of low calorific value and usually very high in moisture) occurs in the South Arcot District of Madras State and in small quantity in Bikaner. The frontispiece is a map of India showing the various coalfields.

The coals of Bengal & Bihar and of the Outlying Fields are of bituminous varieties and may be broadly classified under the following two types:—

- (i) *Coking coals*—low to medium volatile (20% to 33%), with low moisture from 1% to 3%. These coals have strong caking properties, and are generally suitable for manufacture of metallurgical coke.
- (ii) *Non-coking coals*.—high in volatiles (usually over 33%), moderately high in moisture from 4% to 15%. These coals have weakly-caking or non-caking properties, and are used for steam generation and other purposes.

Certain coals are, however, intermediate in type between (i) and (ii) above.

Coals of Jharia and Bokaro Coalfields are of the coking type, while those of the Raniganj and Karanpura Fields are mostly of the non-coking type (including weakly coking), except in the Western region of Raniganj field where the coals are generally coking. Coals available in the Outlying Fields are mostly non-coking.

Lignite may be regarded as bituminous coal of low calorific value but it is often low in ash and can be used in thermal power stations near the mines, in the manufacture of briquettes (domestic fuel), of gaseous and liquid fuels, and of chemicals. Its extraction and utilisation on a commercial scale has now been undertaken in South Arcot by the Government of India.

Coal Grading— 1926.

3. Within each type of bituminous coal, *i.e.*, coking or non-coking, there is a wide variation in the natural content of moisture and ash, and in the calorific value of coal. This has necessitated the grading of coals into different categories. The first attempt at grading was made by the Coal Grading Board, set up by the Government of India in 1925, to regulate and improve the exports of coal which had declined in the years 1922 to 1925 due to lack of specifications for different qualities of coal. The Indian Coal Grading Board adopted the following scheme for grading coals :—

“INDIAN COAL GRADING BOARD SCHEME (1926)

Low moisture and low volatile coal (coking)

—Barakar and Kurhurbaree Series—

- Up to, but not exceeding 13% ash and over
7,000 calories per gram (12,600 Btu per lb.) Selected Grade
- Up to, but not exceeding 15% ash and over 6,500
calories per gram (11,700 Btu per lb.) Grade I (One)

Up to, but not exceeding 18% ash and over 6,000
calories per gram (10,800 Btu per lb.) Grade II (Two)
Any coals inferior to the above . . Grade III (Three)

High moisture & high volatile coal (non-coking)

—Raniganj Series—

Up to, but not exceeding 11% ash over 6,800
calories (12,300 Btu per lb.) and under
6% moisture . . . Selected Grade

Up to, but not exceeding 13% ash, over 6,300
calories (11,400 Btu per lb.) and under
9% moisture . . . Grade I (One)

Up to, but not exceeding 16% ash, over 6,000
calories (10,800 Btu per lb.) and under
10% moisture . . . Grade II (Two)

Any coals inferior to the above . . Grade III (Three)"

It will be seen that in 1926 the Coal Grading Board took into consideration ash, moisture, and calorific value as the three factors determining the grade of coal. The internal market was not controlled by this Grading Scheme.

Colliery Control Order, 1944.

4. The onset of the industrial slump following the First World War led to a crisis in the coal industry in the years following 1926. The lowest prices were touched in 1936. This left the industry in an exhausted state. With the advent of the Second World War, the demands for coal increased rapidly but, as production had fallen during the pre-war crisis, coal was in short supply and consumers had to pay exorbitant prices. With a view to stimulating production and stabilising prices, the Colliery Control Order was promulgated in 1944, and the Government of India assumed control over distribution and coal prices. For this purpose the Coal Commissioner's Organisation was set up and continues to function to this day.

Grading Scheme, 1944.

5. One of the steps taken by the Coal Commissioner's Organisation was to introduce a Grading Scheme in 1944, for the internal market. The scheme is applicable only to coals of Bengal and Bihar Coalfields and is given below :—

COAL FROM SEAMS OF RANIGANJ SERIES

Non-coking (High volatile and high moisture)

If the ash and moisture content thereof—

(i) does not exceed 17·5%	·	·	·	Sel. A
(ii) exceeds 17·5%, but does not exceed 19%	·	·	·	Sel. B
(iii) exceeds 19%, but does not exceed 24%	·	·	·	Grade I
(iv) exceeds 24%, but does not exceed 28%	·	·	·	Grade II

COAL FROM ANY OTHER SEAMS

Coking (Low volatile and low moisture)

If the ash thereof —

(i) does not exceed 15%	·	·	·	Sel. A
(ii) exceeds 15%, but does not exceed 17%	·	·	·	Sel. B
(iii) exceeds 17%, but does not exceed 20%	·	·	·	Grade I
(iv) exceeds 20%, but does not exceed 24%	·	·	·	Grade II
(v) exceeds 24%, but does not exceed 28%	·	·	·	Grade III A
(vi) exceeds 28%, but does not exceed 35%	·	·	·	Grade III B

It will be seen that non-coking coals (high volatile and high moisture) have been graded on the basis of 'ash plus moisture', whereas coking coals (low volatile and low moisture) have been graded on the basis of 'ash' only. Coking coals have about 2% moisture which, if added to the 'ash' for these coals, would make the grading of coking and non-coking coals follow practically the same 'ash plus moisture' scale, grade for grade. The omission of calorific value (specified in the 1926 grading Scheme) from the 1944 Grading Scheme is significant and implies that 'ash plus moisture' alone determines the fuel value of coal.

'Ash plus Moisture' and Calorific Value Relationship.

The results of laboratory tests on a large number of samples drawn from coal supplied to Railways show that there is a relationship between 'ash plus moisture' and calorific value but differently for coking and non-coking coals. The relation-ships are presented in graph I at page 5, and table 1 below for the different types and grades of coal.

TABLE 1.—*Relationship between 'Ash/Ash plus Moisture' and Calorific Value*

Grade of Coal	Low volatile coking coals			High volatile non-coking coals		
	Ash content* (2% added for moisture)	Calorific value (Btu/lb.)		† Ash and moisture content	Calorific value (Btu/lb.)	
		Range	Average		Range	Average
Sel. A	Up to 17%	13000—12700	12850	Up to 17.5%	12200—11800	12000
Sel. B	17 to 19%	12700—12300	12500	17.5 to 19%	11800—11600	11700
Gr. I	19 to 22%	12300—11600	11950	19 to 24%	11600—10800	11200
Gr. II	22 to 26%	11600—10800	11200	24 to 28%	10800—10000	10400

*Moisture in coking coals generally ranges from 1 to 3%.

†Moisture in non-coking coals generally ranges from 4 to 15%.

It will be observed that, although the grading of coking and non-coking coals, follows practically the same 'ash plus moisture' scale, yet the calorific value of coking coal corresponds to that of non-coking coal one grade higher. The prices of coals, coking or non-coking are practically the same, grade for grade.

To equate coking and non-coking coals, grade for grade on 'ash plus moisture' scale, becomes anomalous, as the calorific value of non-coking coals is much lower than that of coking coals, grade for grade.

The Indian Coalfields Committee, 1946 emphasised the importance of physical and chemical analysis of coal resources in the country and made the following observations :—

“In our view, a survey of Indian coals is necessary for more than one reason of national importance and it should, therefore, be undertaken primarily at Government expense.....

Two points may be mentioned here. There has been much criticism of the present basis of grading for export purposes. It is also alleged that the results of the analysis are expressed in unsound terms which convey to the consumer little knowledge of the real fuel value of the coal. Be that as it may, we think that the present basis has proved useful as a rough and ready guide to the calorific values of certain Indian coals, but we agree that grading or classification

should in future be based upon the detailed chemical and physical survey, the results of which should be stated in internationally accepted terms."

The Committee agree with the above observations. It is internationally accepted that, in addition to the physical (coking or non-coking) and chemical (ash, moisture, volatile matter, etc.) properties, calorific value should be specified in the grading or classification of coal, as the price paid for a grade of coal by the consumer should be related to the heat value.

Pricing of Coals.

6. Prior to the introduction of Colliery Control Order, 1944, coals of Bengal and Bihar were graded only for the export market, and not for the internal market. The consumers obtained their coal on competitive basis. Although the prices of coals varied in different States, the average prices per ton on All-India basis for the years 1920 to 1957 were as in table 2 below :—

TABLE 2.—Average Prices of Coal, 1920-1957

Year	Price per ton (All India)		
	Rs.	As.	Ps.
1920	5	3	0
1921	6	12	0
1922	7	11	0
1923	7	7	0
1924	7	1	0
1925	6	1	0
1926	4	13	0
1927	4	5	0
1928	3	15	0
1929	3	13	0
1930	3	14	0
1931	3	13	0
1932	3	6	0
1933	3	2	0
1934	2	14	0
1935	2	13	0
1936	2	12	0
1937	3	2	0
1938	3	12	0
1939	3	9	0
1940	3	9	0
1941	3	11	0
1942	4	7	0
1943	6	10	0
1944	10	15	0
1945	13	0	0
1946	12	14	0
1947	14	4	0
1948	16	4	0
1949	16	4	0
1950	15	14	6
1951	15	9	0
1952	15	8	3
1953	15	8	0
1954	15	9	6
1955	15	9	6
1956	17	13	3
1957	19	4	0

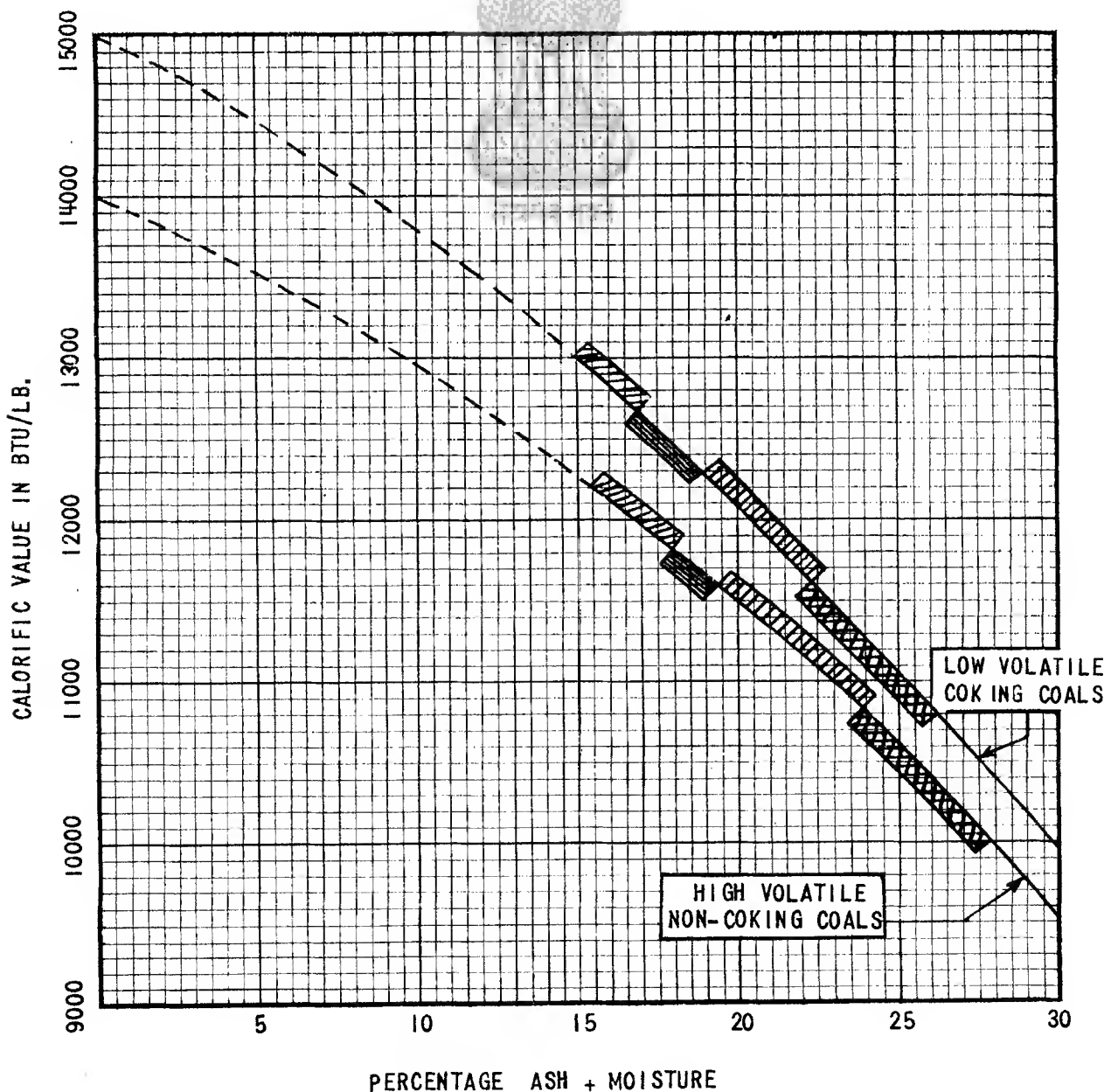
1920—43: Prices furnished by the Indian Coalfields Committee 1946.

1944—57 : Prices worked out on the basis of coal supplied to Railways.

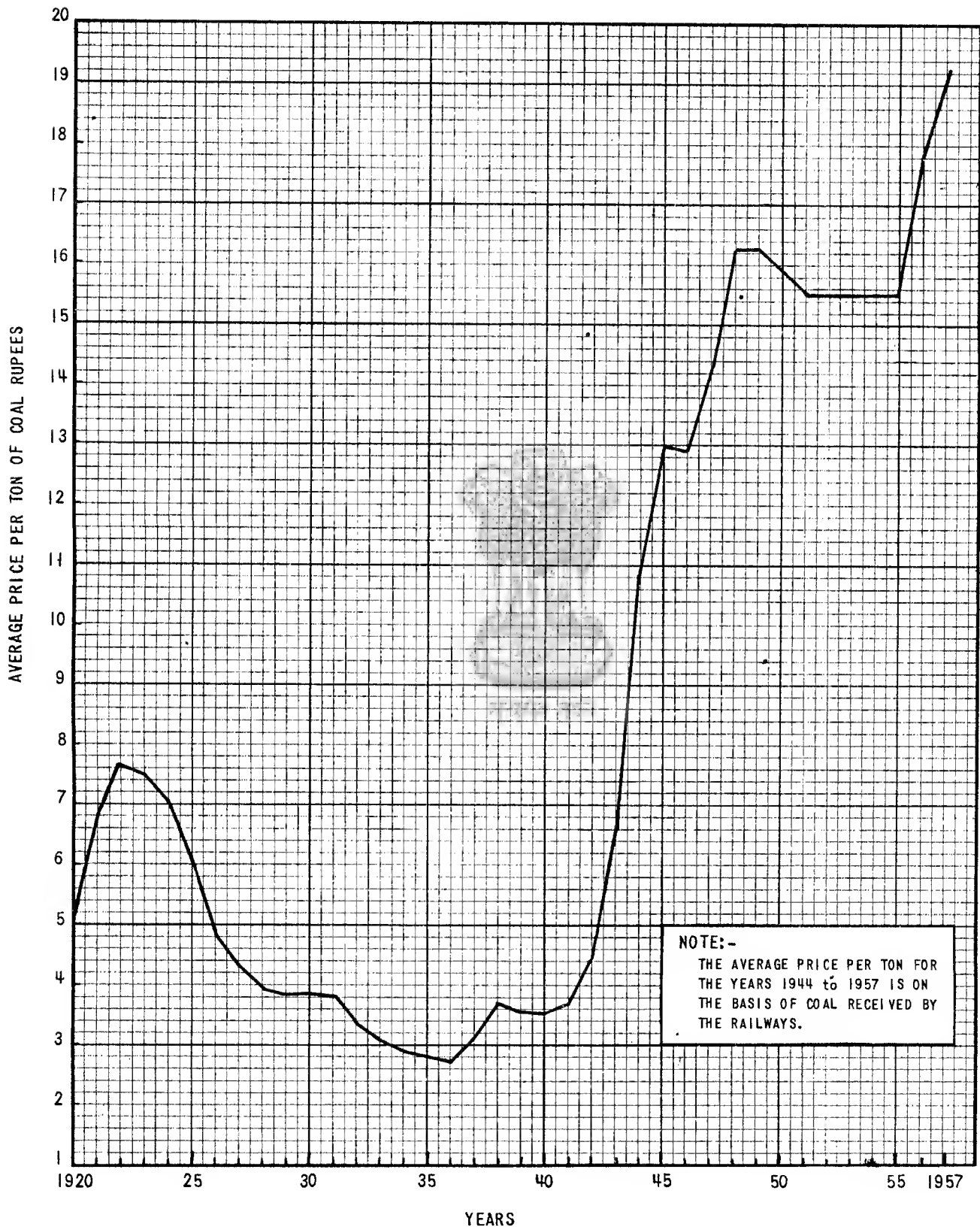
It will be seen that during the period 1928 to 1941 the prices of coal remained below Rs. 4/- per ton, touching the lowest figure of Rs. 2/12/- per ton in 1936. Graph II at page 6 shows the trends of coal prices from 1920 to 1957.

GRAPH I - RELATIONSHIP BETWEEN ASH + MOISTURE & CALORIFIC VALUE

GRADE OF COAL	LOW VOLATILE COKING COALS			HIGH VOLATILE NON-COKING COALS		
	ASH CONTENT (+ 2% ADDED FOR MOISTURE)	CALORIFIC VALUE		ASH + MOISTURE CONTENT.	CALORIFIC VALUE	
		RANGE BTU/LB.	AVERAGE BTU/LB.		RANGE BTU/LB.	AVERAGE BTU/LB.
SELECTED 'A'	UP TO 17.0%	13000-12700	12850	UP TO 17.5%	12200-11800	12000
SELECTED 'B'	17.0-19.0%	12700-12300	12500	17.5-19.0%	11800-11600	11700
GRADE - I	19.0-22.0%	12300-11600	11950	19.0-24.0%	11600-10800	11200
GRADE - II	22.0-26.0%	11600-10800	11200	24.0-28.0%	10800-10000	10400



GRAPH II - AVERAGE PRICE FLUCTUATIONS OF COAL DURING THE YEARS 1920-1957.



**Coal Prices
fixed in 1944.**

After the introduction of the Colliery Control Order (1944), Bengal & Bihar coals were graded and priced in May 1944 without any distinction between coking and non-coking coals, as shown in table 3 :—

TABLE 3—*Prices of Bengal & Bihar Coals fixed in May 1944*

Grade	Price per ton of steam coal		Price Index
	Rs.	As. P.	
Selected 'A'	13	0 0	100·0
Selected 'B'	12	0 0	92·3
Grade I	11	2 0	85·6
Grade II	10	12 0	82·7

The coals of the Outlying Fields were priced according to local conditions but not graded, and prices had no bearing on the quality of coal produced. The prices fixed for a few sources in July 1944 were as follows :—

Coalfield	Average price per ton		
	Rs.	As.	Ps.
Assam	30	0 0	
Madhya Pradesh	13	1 0	
Orissa	11	1 0	

To quote the Indian Coalfields Committee 1946, "*Add hoc* fixation of prices under the Colliery Control Order in 1944 was dominated by the need for more production and hence increased costs, occasioned by higher wages and grain allowances, etc., and an additional inducement for Colliery owners in the shape of an increased margin of profit, inevitably figured largely in determining the actual scale of prices."

**Subsequent
Changes in
Prices.**

Increases or decreases in prices of Bengal and Bihar coals, subsequent to 1944, were sanctioned uniformly for all grades of coal as in table 4.

TABLE 4—*Changes in Prices of Bengal & Bihar Coals (1944-58)*

Date of Change	Increase (+) decrease (—) per ton.		
	Rs.	As.	Ps.
July 1944	10	5 0	
July 1947	13	8 0	
November 1949	—0	9 0	
July 1955	+0	3 0	
July 1956* :			
Coking	+3	3 0	
Non-coking	+3	0 0	
July 1957 :			
Coking	+1	8 0	
Non-coking	+1	8 0	
May 1958 :			
Coking	+0	12 0	
Non-coking	+0	12 0	

*Separate rates for coking and non-coking coals were introduced in July 1956.

**Current Prices
& Calorific
Value Indices.**

The current prices and relative calorific values of steam coals (coking and non-coking separately) obtained from Bengal and Bihar are given in table 5, and Graph III at page 9. Selected A Grade Coking Coal has been given an index of 100 for purposes of comparison.

TABLE 5.—1958 Current Prices, with their Index and Relative Calorific Value Index of Bengal and Bihar Coals

Grade	Coking		Non-coking		*Calorific Value Index for coking & non-coking coals, grade for grade	
	Price of steam coal in Rs. per ton	*Price Index	Price of steam coal in Rs. per ton	*Price Index	Coking	Non-coking
Sel. A	21.87	100.0	21.69	99.17	100.0	93.4
Sel. B	20.87	95.5	20.69	94.6	97.3	91.0
Gr. I	20.00	91.5	19.81	90.6	91.9	87.2
Gr. II	18.87	86.4	18.69	86.0	87.2	81.0

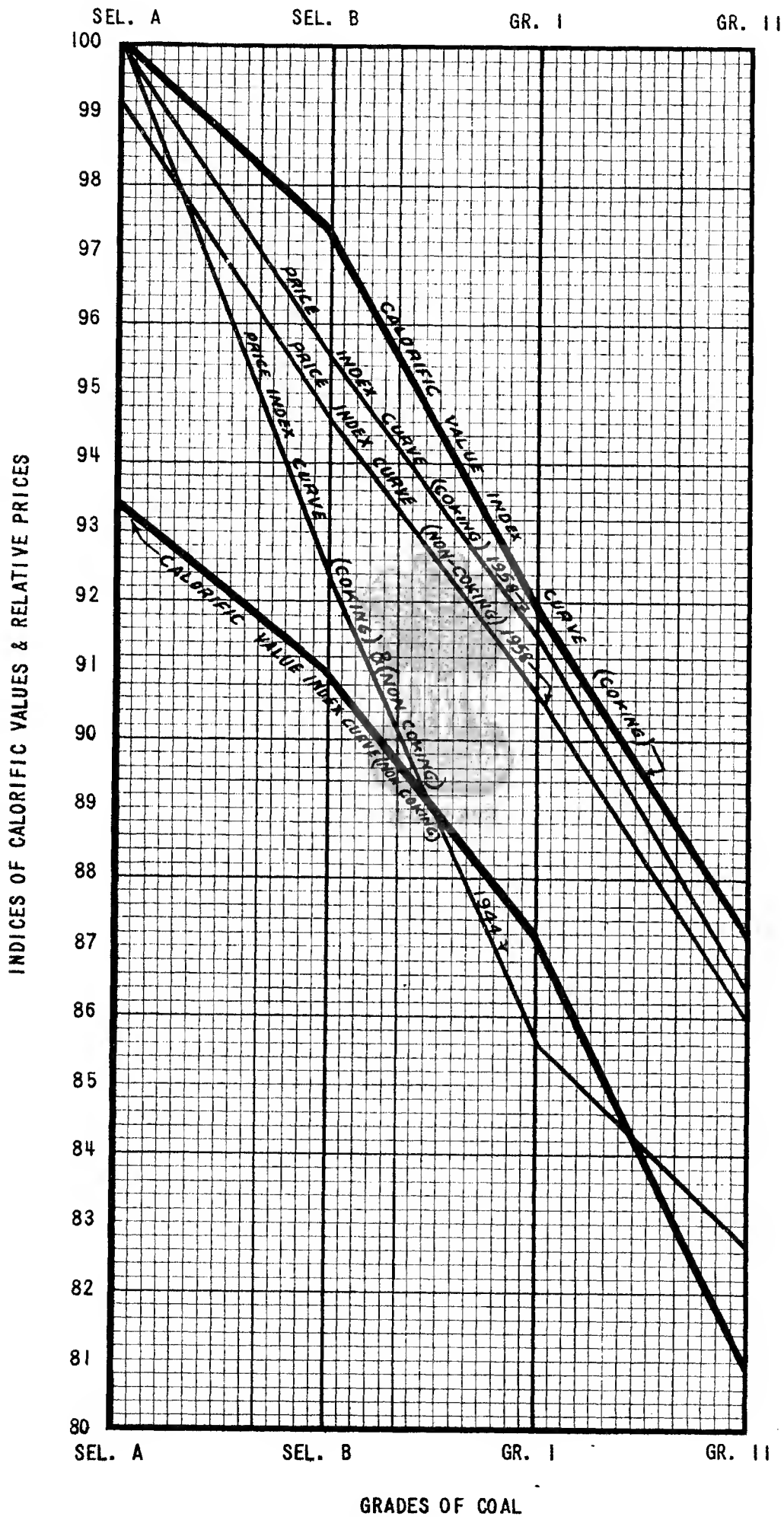
*Assuming Sel. A grade coking coal to be 100.

A study of tables 3 and 5 and graph III would show that the calorific value index of non-coking coal is 6% to 8% lower than that of coking coals, and the indices of prices fixed in 1944 applicable both to coking and non-coking coals follow closely the calorific value indices of non-coking coals (with the exception of non-coking selected Grade A). As the calorific values of coking coals are higher than those of non-coking coals, grade for grade, the 1944 prices were favourable to the users of coking coals.

The 1958 price indices resulting from successive revisions, however follow closely the calorific value indices of coking coals, the price indices of non-coking coals being nearly 1% lower. Even though prices of coking and non-coking coals, grade for grade, are practically the same, non-coking coals are equivalent to coking coals of at least one grade lower (which cost Re. 1/- per ton less) on the basis of calorific value. In other words, non-coking coal costs at present about Re. 1/- per ton more than coking coal of the same calorific value.

Further, the gap in the price indices of selected A and Grade II coals has been narrowed down from 17.3% in 1944 to 13.6% in 1958 due largely to fixing the same increments in price irrespective of grade of coal. This has resulted in distortion of the price structure and there is now inadequate valuation of high grade coals and over-valuation of low grade coals by comparison. The consumer of low grade coals is thus at a serious disadvantage. The narrow gap in prices also tends to discourage upgrading of inferior coals by washing them, as it is uneconomic to do so.

GRAPH III - RELATIVE CALORIFIC VALUE INDICES OF COKING & NON-COKING COALS AND THEIR RELATIVE PRICE INDICES IN THE YEARS 1944 & 1958.



**Current Prices-
Outlying
Fields.**

The range of current prices of steam coals of the Outlying Fields which are applicable to all coals produced in each area, though the coals are of widely varying quality, are shown below :—

State	Rate per ton
Madhya Pradesh	Rs. 19.00 to Rs. 23.44
Orissa	Rs. 21.81 to Rs. 22.81
Andhra Pradesh	Rs. 26.75 to Rs. 27.75
Assam	Rs. 26.94 to Rs. 43.44
Bombay	Rs. 20.94 to Rs. 21.50

**'Useful Heat'
in Coal.**

7. It is, however, not the total calorific value of coal which gives the consumer value for money spent on fuel as there are always performance losses in utilisation, and the 'useful heat' derived is less than the calorific value. The Fuel Research Institute has made a study of the characteristics of coals in relation to performance, and suggested* price evaluation on the basis of 'useful heat'. In regard to this basic principle, the Railway Fuel Economy Enquiry Committee 1953 have observed† as follows :—

“The Fuel Research Institute and the Central Standards Office for Railways agree on the basic principle of price evaluation which unlike the existing price grading scheme consists in fixing a price scale for the useful heat of each grade of coal in actual combustion”.

The Coal Washeries Committee 1954 have also observed** as follows :—

“It is mostly admitted that the present price structure of coal of different grades as well as of different moisture contents is irrational.

* * * * *

The F.R.I. Scheme is an improvement on the National Coal Board Scheme in so far as the fixation of price structure on 'useful heat' content eliminates the factors of fluctuating moisture content in various types of coals.

* * * * *

There is much to commend in this price structure scheme.”

**'Useful Heat'
as a Rational
Basis for Pricing.**

8. It has been suggested by the Central Fuel Research Institute that the price structure should be drawn up on the score of useful heat units as given by the formula :—

$$Hu = \frac{100 - 1.5 Ad}{100} \times Bu$$

where Hu = the useful heat units,
Ad = the ash in the dry coal, and
Bu = calorific value of the pure coal substance (i.e. unit coal) in Btu per lb.

This formula for Indian coal applies to the performance of stationary boilers where for every 1% increase in ash there is 1.5% increase in consumption of coal.

Based on useful heat value, the relative performance of locomotive boilers and prices of different grades of non-coking coals (which will be the coals for steam locomotives in future) are indicated in table 6.

*Article entitled “The price of coal, raw and washed” published in the November 1951 issue of Fuel Research Institute News.

†Vide para 68 of the Railway Fuel Economy Enquiry Committee Report, 1953.

**Vide paras 26 and 27, Chapter VI of the Washeries Committee Report, 1954.

TABLE 6 — *Relative Prices of Various Grades of Non-Coking Coal based on Useful Heat Values*

Grade of coal	Average calorific value (non-coking coal) Btu/lb.	Average combustion efficiency of locomotives	Useful heat value [(2)×(3) ÷ 100] Btu/lb.	Price of coal based on Rs. 22 for 10000 Btu of useful heat [(4) × Rs. 22 ÷ 10000] Rs.	Present price of steam coal (Bengal & Bihar) Rs.
(1)	(2)	(3)	(4)	(5)	(6)
Set. A	12000	81·2	9744	21·43	21·69
Set. B	11700	78·7	9208	20·26	20·69
Gr. I	11200	75·0	8400	18·48	19·81
Gr. II	10400	70·5	7332	16·13	18·69

From the above table it will be seen that the difference between the current prices of Selected 'A' and Grade II coal is only Rs. 3 (Column 6), whereas the difference based on 'useful heat' value is over Rs. 5 (Column 5). This shows how the narrow range of the present price scale (Selected A to Grade II) adversely affects consumers compelled to use low grade coals. Moreover, the margin of difference in the existing prices *viz.* Rs. 3 (instead of Rs. 5) is inadequate to cover cost of washing low grade coals.

Price Structure by National Coal Board, U K.

9. Based on experimental work and statistical data in respect of a number of plants, the National Coal Board of U. K. have arrived at a price structure which aims at reflecting the actual value of the coal to the user. This price structure is based mainly on the effect of 'ash' on the useful heat of coal.

Assuming a calorific value of unit coal (dry and ashless) of 15,000 Btu/lb., table 7 below shows the adjusted calorific value after making suitable deduction for the effect of 'ash' in coals having 'moisture' of 7% and 'ash' of 10% to 30%. It shows the 'relative evaluation' which is proportional to the adjusted calorific value (useful heat value), assuming the 10% ash coal to be unity. [Indian coals have at least 10% ash.]

TABLE 7 — *Relative Evaluation of Coals based on adjusted Calorific Value.*

Grades corresponding to Coal Commissioner's Grading	Ash plus moisture %	Ash %	Calorific value of coal as received. Btu/lb.	Deduction for a h p' u : moisture Btu/lb.	Adjusted calorific value (useful heat) Btu/lb.	Relative evaluation.
Set. A	17	10	11900	260	11640	1·00
Gr. I	22	15	11200	560	10640	0·915
Gr. II	27	20	10300	1030	9270	0·796
	32	25	9600	1650	7950	0·682
	37	30	8750	2440	6310	0·542

Thus, according to the above table coal containing 10% ash and 7% moisture costing, say Rs. 21/8/- per ton at pithead, would be worth only Rs. 17·1, *i.e.* (21/8 × 0·796) per ton, if the 'ash' were increased to 20%. This evaluation of the National Coal Board corresponds well with the results arrived at in table 6.

Summary

10. The salient observations made in the Chapter are summarised below :—

- I. The current grading of Bengal and Bihar coals is not based on their calorific value but on 'ash plus moisture' only. While within each type there is a general correspondence between 'ash plus moisture' and calorific value, non-coking coals fall one grade below coking coals in respect of calorific value.
- II. (a) As a result of uniform increases in the prices of the different grades of coal during the period 1944 to 1958 the price difference between Selected A and Grade II coals, which was 17·3% in 1944 when the coals were first graded, has been reduced to 13·6% in 1958.
 (b) While non-coking coals are priced only as, -/3/- less per ton than coking coals (i.e. .8 to 1% lower), grade for grade, the calorific value of the non-coking coals is lower by 700 to 800 Btu/lb. (i.e. 6% to 8%).
 (c) In calorific value non-coking coals correspond to coking coals of one grade lower; but the non-coking coals cost about Re. 1/- per ton more.
- III. (a) On the basis of useful heat value the present prices for Grade I and Grade II coals of Bengal & Bihar coal fields are higher than they should be in comparison with the prices of selected grades. This adversely affects the consumers of low grade coals.
 (b) The narrow differences in present prices from grade to grade do not provide an incentive to the producer to prepare and sell better quality of coal.
- IV. The price structure, which is unrelated to calorific value or useful heat of coal, is unrealistic.
- V. The coals of Outlying Fields being ungraded, the consumer has to pay the same price for coals varying considerably in quality.



CHAPTER II

TRENDS IN EXPENDITURE ON RAILWAY COAL

11. The trends in Railway coal consumption and expenditure have to be viewed against the background of the changing pattern of the country's economy. During the last 30 years, both the country and the Railways have witnessed many changes. Starting from 1926, the Railways appeared to have emerged from the effects of World War I by 1929 and there were signs of steady progress during this period. Then followed the world-wide economic depression which halted Railway progress during the five years 1930-35. The Railways had just recovered from the slump in traffic when the Second World War broke out in 1939, making it necessary for the Railways to muster all their resources for the war effort. Soon after the war, the partition of the country in 1947 dislocated the working of Indian Railways. Unsettled conditions continued up to 1952, till the Railways had been re-organised after integration of Railways formerly owned and managed by the Companies and Indian States. The working conditions on Railways have, since 1952 shown stability and uniformity. The 30-year period from 1926-27 to 1956-57 can thus be broadly divided into :—

- (a) 1926-30—period of steady progress in rail transport.
- (b) 1930-35—period of economic depression in India, resulting from the world economic crisis.
- (c) 1935-40—period showing relatively stable economic conditions. The Burma Railways, however, separated from Indian Railways in 1937-38.
- (d) 1940-47—period of the Second World War and its effects, including the sharp inflationary trends in the economy of the country. The Railways during this period worked under severe stress and were unable to give attention to rehabilitation of their assets, Rolling Stock, track and equipment.
- (e) 1947-52—period of rehabilitation and reform of Railways after Partition. The reform became necessary after the Integration of Indian States in 1949-50, and consisted of the merger of a number of small Railways owned by Indian States with the Government Railways.
- (f) 1952-57—period of some stability and uniformity in working conditions on Railways after the formation of Zonal Railways.

Trends in Different Periods.

12. The Committee have examined the trends of annual expenditure on Railway coal during the last 30 years. In table 8 at page 14 are given the figures of consumption of coal in tons on Class I Railways (as they stood from time to time), the average prices of coal, the average freight rates and the expenditure (excluding handling and incidental costs) on coal for the years 1926-27 to 1956-57. The route mileage, the gross ton miles carried on Class I Railways and their total working expenses for each year are also shown for comparison.

From the figures furnished in table 8, the relative indices of gross ton miles, tons of coal consumed, the costs of coal and total working expenses have been worked out for the years 1926-27 to 1956-57, taking 100 as the base for the year 1926-27. The evaluated indices are given in tables 9(a) to 9(f) at page 15, for each sub-period.

TABLE 8—Gross Ton Miles, Coal Consumption, Costs of Coal and Working Expenses of Railways.

Year	Route Miles	Gross ton miles	Tons of coal consumed	Average pithead price per ton	Total pit-head costs	Average freight rate per ton	Total freight costs	Total cost of coal [col.(6) col.(8)]	Total working expenses	Percentage of col. (9) to col. (10)
		(000,000)	(000)	(Rs.)	(000)	(Rs.)	(000)	(000)	(000)	
I	2	3	4	5	6	7	8	9	10	11
<i>Period 1926-27 to 1929-30</i>										
1926-27	35,132	78,090	6,800	5.55	3,77,40	8.13	5,52,84	9,30,24	67,28,15	13.8
27-28	35,587	83,821	7,048	4.51	3,17,54	7.94	5,59,93	8,77,47	69,84,37	12.6
28-29	36,748	86,044	7,222	4.38	3,16,38	7.71	5,56,91	8,73,29	71,18,32	12.3
29-30	37,535	85,981	7,361	4.21	3,10,21	7.49	5,51,26	8,61,47	73,81,74	11.7
<i>Period 1930-31 to 1934-35</i>										
1930-31	38,020	82,838	7,289	4.40	3,20,92	7.37	5,37,36	8,58,28	72,00,42	11.9
31-32	38,460	75,123	6,412	4.44	2,84,97	7.16	4,58,84	7,43,81	65,14,34	11.4
32-33	38,566	72,871	6,232	4.31	2,68,68	7.35	4,58,29	7,26,97	63,66,79	11.4
33-34	38,298	76,006	6,451	4.01	2,58,70	7.20	4,64,48	7,23,18	64,31,16	11.2
34-35	38,294	81,036	6,892	3.59	2,47,15	7.02	4,83,64	7,30,79	65,93,97	11.1
<i>Period 1935-36 to 1939-40</i>										
1935-36	38,367	82,552	7,052	3.41	2,40,34	6.65	4,68,80	7,09,14	66,37,41	10.7
36-37	38,185	85,036	7,228	3.28	2,36,74	6.72	4,85,64	7,22,38	67,47,05	10.7
37-38	36,134	87,181	7,623	3.34	2,54,97	6.68	5,09,23	7,64,20	67,12,01	11.4
38-39	36,573	87,729	7,942	3.86	3,06,91	6.72	5,33,48	8,40,39	68,79,22	12.2
39-40	36,557	90,256	8,111	3.70	3,00,25	6.59	5,34,27	8,34,52	69,81,09	12.0
<i>Period 1940-41 to 1946-47</i>										
1940-41	36,393	94,294	8,381	3.83	3,21,03	6.79	5,69,08	8,90,11	70,70,01	12.6
41-42	36,861	100,594	9,199	4.01	3,68,61	6.87	6,32,09	10,00,70	78,31,39	12.8
42-43	36,792	92,786	9,019	4.33	3,90,61	7.07	6,37,60	10,28,21	84,34,25	12.2
43-44	36,798	93,705	9,420	6.93	6,52,50	7.78	7,32,72	13,85,22	1,11,31,76	12.4
44-45	36,795	99,518	9,757	10.93	10,65,98	10.37	10,11,66	20,77,64	1,45,57,49	14.3
45-46	36,899	104,205	10,374	13.00	13,48,86	9.10	9,43,87	22,92,73	1,65,87,05	13.8
46-47	36,906	100,258	10,746	12.88	13,84,05	9.38	10,08,22	23,92,27	1,75,08,00	13.7
<i>Period 1947-48 to 1951-52</i>										
1947-48	30,341	74,918	8,687	14.26	12,38,55	8.15	7,08,31	19,46,86	1,58,97,84	12.2
48-49	30,125	81,531	9,578	16.25	15,56,76	11.14	10,67,25	26,24,01	1,77,95,62	14.7
49-50	31,010	89,684	10,000	16.26	16,26,25	13.47	13,46,81	29,73,06	2,01,45,81	14.8
50-51	31,030	95,418	10,318	15.92	16,42,54	12.96	13,37,27	29,79,81	2,12,67,14	14.0
51-52	33,343	100,890	10,728	15.55	16,68,28	13.67	14,66,70	31,34,98	2,25,76,29	13.9
<i>Period 1952-53 to 1956-57</i>										
1952-53	33,519	102,131	11,211	15.52	17,39,54	13.10	14,68,35	32,07,89	2,34,07,28	13.7
53-54	33,852	104,320	11,270	15.50	17,46,74	13.35	15,04,26	32,51,00	2,46,01,68	13.2
54-55	34,152	110,989	11,711	15.60	18,26,59	14.16	16,58,85	34,85,44	2,52,81,08	13.8
55-56	34,182	120,387	12,367	15.59	19,27,96	14.78	18,28,17	37,56,13	2,77,79,18	13.5
56-57	34,291	129,918	13,392	17.83	23,87,84	15.15	20,28,40	44,16,24	3,00,75,15	14.7

NOTE.—Figures in col. 4 for the years 1952-53 to 1956-57 represent quantity received by the Railways for which pit-head and freight costs were paid.

TABLE 9—*Relative Consumption and Costs of Railway Coal*

Year	Route miles	Gross ton Miles Index	Tons of coal consumed Index	Costs of coal Index	Total Working Expenses Index
(1)	(2)	(3)	(4)	(5)	(6)
9(a) : <i>Sub-period (a)—1926-27 to 1929-30</i>					
1926-27 .	35,132	100·0	100·0	100·0	100·0
1927-28 .	35,587	107·3	103·6	94·3	103·8
1928-29 .	36,748	110·2	106·2	93·9	105·8
1929-30 .	37,535	110·1	108·2	92·6	109·7
9(b) : <i>Sub-period (b)—1930-31 to 1934-35</i>					
1930-31 .	38,020	106·1	107·2	92·3	107·0
1931-32 .	38,460	96·2	94·3	80·0	96·8
1932-33 .	38,566	93·3	91·6	78·1	94·6
1933-34 .	38,298	97·3	94·9	77·7	95·6
1934-35 .	38,294	103·8	101·4	78·6	98·0
9(c) : <i>Sub-period (c)—1935-36 to 1939-40</i>					
1935-36 .	38,367	105·7	103·7	76·2	98·7
1936-37 .	38,185	108·9	106·3	77·7	100·3
1937-38 .	36,134	111·6	112·1	82·1	99·8
1938-39 .	36,573	112·3	116·8	90·3	102·2
1939-40 .	36,557	115·6	119·3	89·7	103·8
9(d) : <i>Sub-period (d)—1940-41 to 1946-47</i>					
1940-41 .	36,393	120·8	123·2	95·7	105·1
1941-42 .	36,861	128·8	135·3	107·6	116·4
1942-43 .	36,792	118·8	132·6	110·5	125·4
1943-44 .	36,798	120·0	138·5	148·9	165·5
1944-45 .	36,795	127·4	143·5	223·3	216·4
1945-46 .	36,899	133·4	152·6	246·5	246·5
1946-47 .	36,906	128·4	158·0	257·2	260·2
9(e) : <i>Sub-period (e)—1947-48 to 1951-52</i>					
1947-48 .	30,341	95·9	127·7	209·3	236·3
1948-49 .	30,125	104·4	140·9	282·1	264·5
1949-50 .	31,010	114·8	147·1	319·6	299·4
1950-51 .	31,030	122·2	151·7	320·3	316·1
1951-52 .	33,343	129·2	157·8	337·0	335·5
9(f) : <i>Sub-period (f)—1952-53 to 1956-57</i>					
1952-53 .	33,519	130·8	164·9	344·8	347·9
1953-54 .	33,852	133·6	165·7	349·5	365·7
1954-55 .	34,152	142·1	172·2	374·7	375·8
1955-56 .	34,182	154·2	181·9	403·8	412·9
1956-57 .	34,291	166·4	196·9	474·7	447·0

Sub-period (a) (1926-27 to 1929-30).—By the end of this period, the gross ton miles increased by about 10%, coal consumption by about 8%, total working expenses by 9·7 %, but the cost of coal came down by about 7·4%. This reduction in the cost of coal is explained by the fall in the price of coal which had commenced from the year 1926-27. It will be seen that this was a period of steady progress in rail transport.

Sub-period (b) (1930-31 to 1934-35).—During this period of general economic depression, the traffic commenced dropping in 1930-31 and touched the lowest figure in 1932-33. The index of coal consumption followed closely the index of the volume of traffic. The cost of coal, however, continued to drop on account of the downward trend of coal prices and the index fell in 1934-35 to 78·6 (1926-27=100). The index of working expenses also showed a drop to 98. This was the natural result of the economic depression and the retrenchment measures adopted during this period.

Sub-period (c) (1935-36 to 1939-40).—This was the post-depression period, during which the traffic index rose from 105·7 in 1935-36 to 115·6 in 1939-40 in spite of the separation of Burma Railways in 1937-38, involving a reduction of about 2,000 in route miles. The coal consumption index also rose from 103·7 to 119·3. There was a close correspondence between the coal consumption index and the gross ton miles index up to 1937-38, but during the last two years of this sub-period, the coal consumption increased at a somewhat higher rate. The index of coal costs increased from 76·2 in 1935-36 to 89·7 in 1939-40, showing a rising trend in coal prices; the working expenses index rose from 98·7 to 103·8.

Sub-period (d) (1940-41 to 1946-47).—This sub-period was affected by World War II, as a result of which the traffic increased sharply and the gross ton miles index rose from 120·8 in 1940-41 to 128·4 in 1946-47. The rise in the coal consumption index, however, was from 123·2 to 158, showing relatively greater increase in coal consumption. There was a marked increase in the coal costs index, i.e. from 95·7 in 1940-41 to 257·2 in 1946-47. This was due largely to the fixation of increased coal prices under the Colliery Control Order, 1944, and increase in freight rates. The total working expenses index rose from 105·1 in 1940-41 to 260·2 in 1946-47, showing that the increase in the coal bill was in step with the increase in working expenses.

Sub-period (e) (1947-48 to 1951-52).—There was a marked drop in the traffic in 1947-48; the index fell from 128·4 in 1946-47 to 95·9 in 1947-48, the coal consumption index fell from 158 to 127·7, the coal costs index from 257·2 to 209·3 and the working expenses index from 260·2 to 236·3. This general drop was due to the dislocation caused by the Partition of the country and the Railways which resulted in the reduction of route mileage of Indian Railways by about 6,500 miles. During the remaining 4 years, i.e. from 1948-49 to 1951-52, the position gradually improved, and the traffic and coal consumption indices returned to the level of 1946-47. By 1951-52, the coal costs index, however, rose to 337 due to increase in coal prices and freight rates, and the total working expenses index rose to 335·5. During the last two years of this period, Indian Railways were regrouped, and about 2,000 route miles were added to class I Railways by the merger of Darjeeling-Himalayan, Scindia State, Dholpur, Saurashtra, Jaipur, Rajasthan, Kutch etc. Railways with larger units.

Sub-period (f) (1952-53 to 1956-57).—During this period relatively uniform conditions were established after the regrouping of Railways, and with the progress of the First Five Year Plan the traffic index steadily rose from 130·8 in 1952-53 to 166·4 in 1956-57, and the coal consumption index from 164·9 to 196·9. The coal costs index, however increased from 344·8 in 1952-53 to 474·7 in 1956-57, which again was due to the substantial rise in the prices of coal during 1956 and 1957. The working expenses index rose from 347·9 to 447, showing that the coal costs increased somewhat more than the working expenses.

A graph showing the relative trends in the indices of gross ton miles, coal consumption, costs of coal and the total working expenses, for the years 1926-27 to 1956-57, is given at page 18. This graph highlights the following factors :—

- (a) The indices of coal consumption and gross ton miles have followed each other closely from 1926-27 to 1940-41. The coal consumption index rose thereafter more rapidly than the gross ton miles index, reflecting the disturbing effects of the war. The gap has continued since that date, but shows a tendency of gradually narrowing since 1953-54. [That this gap is attributable to deterioration in the quality of coal and to certain other factors is discussed in Chapters III, IV and V.]
- (b) The indices of the cost of coal and working expenses have shown a tendency to move rapidly upwards from 1942-43 under the impact of the changed economic conditions during and since the war. The indices, have however, closely followed each other, showing that the rise in the prices of coal and the increase in working expenses are affected by common economic factors, mainly rise in the cost of labour and materials. [The analysis of the increase in the cost of coal during the period 1952-53 is discussed later in this Chapter.]

Conclusion.

13. The above review shows the trends of coal consumption and expenditure in relation to the volume of traffic in the last 30 years. These trends have been affected by diverse factors beyond the control of the Railways, such as the economic depression of the thirties, the World War II, and the Partition of the country. To draw conclusions from a comparison of trends of coal consumption and expenditure in recent years with the trends in the past periods which were affected by dissimilar working conditions would not be appropriate. It would be more advantageous to analyse and to examine the trends from 1952-53 to 1956-57 when working conditions on Railways were generally uniform and stable, as this will also help to spotlight adverse factors and to effect improvement. The examination has not been continued upto 1957-58 as complete figures are not available.

In the following paragraphs the Committee have analysed the trends of coal consumption and costs on Railways during the years 1952-53 to 1956-57. This period also covers the transport developments in the First Five Year Plan and is indicative of future trends.

Analysis of Coal Consumption and costs during 1952-1953 to 1956-57

Quantity of Coal.

14. The quantity of coal received for loco and non-loco purposes during the years 1952-53 to 1956-57 is shown in table 10 below :—

TABLE 10—*Quantity of Coal*

Year	Loco		Non-loco		Total	
	Quantity received (in million tons.)	Percentage increase(+)/decrease(—) over 1952-53	Quantity received (in million tons.)	Percentage increase(+)/decrease(—) over 1952-53	Quantity received (in million tons.)	Percentage increase(+)/decrease(—) over 1952-53
1952-53 . . .	10.2	..	1.0	..	11.2	..
1953-54 . . .	10.1	—0.2	1.1	+7.7	11.2	+0.5
1954-55 . . .	10.5	+3.7	1.2	+12.3	11.7	+4.5
1955-56 . . .	11.2	+10.6	1.1	+7.8	12.3	+10.3
1956-57 . . .	12.2	+19.8	1.2	+16.1	13.4	+19.5

It will be observed that (a) the consumption of coal for non-loco purposes is of the order of 10% of the consumption on locomotives and (b) by 1956-57, the total quantity of coal consumed has risen by 19.5% over the consumption in 1952-53.

Expenditure on Coal.

15. The increase in expenditure on Railway coal during the period 1952-53 to 1956-57 in relation to the total working expenses is shown in table II.

TABLE II.—*Expenditure on Coal to Total Working Expenses*

Year	Total Working Expenses*		Expenditure on coal (Pithead <i>plus</i> freight costs)		Coal expenditure as a percentage of total working expenses
	Amount (in millions of Rs.)	Percentage variation over 1952-53	Amount (in millions of Rs.)	Percentage variation over 1952-53	
1952-53	2341	..	321	..	13.7
1953-54	2460	+5.1	325	+1.3	13.2
1954-55	2528	+8.0	349	+8.7	13.8
1955-56	2778	+18.7	376	+17.1	13.5
1956-57	3008	+28.5	442	+37.7	14.7

*Inclusive of the proforma freight charges on the carriage of railway stores and fuel.

It will be seen that during the period in question, the total working expenses on the Railways increased from Rs. 2341 millions to Rs. 3008 millions *i.e.* by 28.5% whereas the expenditure on coal increased from Rs. 321 millions to Rs. 442 millions *i.e.* by 37.7%. The annual coal bill fluctuated between 13.2% and 14.7% of the total working expenses.

Break-up of Expenditure on Coal.

16. Expenditure on coal depends upon (1) the quantity consumed and (2) the prices and other charges, which comprise the following :—

- Pithead costs including loading ;
- Freight paid on the movement of coal ;
- Costs of handling coal at receiving sheds ;
- Incidental costs.

For the years 1952-53 to 1956-57 an analysis showing the quantity of coal received, pithead costs and freight charges paid thereon, as well as a break-up of the increase in fuel bill due to (i) increase in quantity, (ii) rise in pithead costs, and (iii) rise in freight rates is given in Appendix 2. The data are discussed in the following paragraphs.

Pit-head Cost of Coal.

Regarding pit-head costs, the variations from 1952-53 onwards are shown in table 12.

TABLE 12.—*Variation in Pithead Costs during 1952-53 to 1956-57*

Year	Loco			Non-Loco			Total		
	Cost (in millions of Rs.)	Percentage increase (+) / decrease (—) over 1952-53	Average rate per ton (Rs.)	Cost (in millions of Rs.)	Percentage increase (+) / decrease (—) over 1952-53	Average rate per ton (Rs.)	Cost (in millions of Rs.)	Percentage increase (+) / decrease (—) over 1952-53	Average rate per ton (Rs.)
1952-53	157.5	..	15.50	16.5	..	15.70	174.0	..	15.52
1953-54	156.8	—0.4	15.46	17.9	+8.5	15.81	174.7	+0.4	15.50
1954-55	164.6	+4.5	15.63	18.1	+9.6	15.32	182.7	+5.0	15.60
1955-56	175.1	+11.2	15.58	17.7	+7.5	15.66	192.8	+10.8	15.59
1956-57	216.9	+37.7	17.81	22.0	+33.0	17.99	238.9	+37.3	17.83

It will be observed that the pit-head cost of coal for 1956-57 was 37·3% higher than that in 1952-53, against the increase in quantity of 19·5% only. This is because the average cost per ton of coal increased from Rs. 15·52 in 1952-53 to Rs. 17·83 in 1956-57 *i.e.* by 14·9%.

Freight Charges.

As regards freight charges the position for the five years is given in table 13.

TABLE 13.—*Freight Charges incurred during 1952-53 to 1956-57*

Year	Loco			Non-Loco			Total		
	Amount paid (in millions of Rs.)	Percentage increase (+)/decrease (—) over 1952-53	Rate per ton Rs.	Amount paid (in millions of Rs.)	Percentage increase (+)/decrease (—) over 1952-53	Rate per ton Rs.	Amount paid (in millions of Rs.)	Percentage increase (+)/decrease (—) over 1952-53	Rate per ton Rs.
1952-53	134·7	..	13·25	12·1	..	11·58	146·8	..	13·10
1953-54	137·2	+1·9	13·53	13·2	+8·6	11·67	150·4	+2·5	13·35
1954-55	152·1	+12·9	14·44	13·8	+13·9	11·74	165·9	+13·0	14·16
1955-56	168·9	+25·4	15·03	13·9	+14·9	12·33	182·8	+24·5	14·78
1956-57	187·1	+38·9	15·37	15·7	+29·8	12·94	202·8	+38·1	15·15

It will be observed that against the 19·5% increase in quantity of coal, increase in freight charges in 1956-57 as compared to 1952-53 was 38·1%. This is because of the increase in average freight rates from Rs. 13·10 per ton in 1952-53 to Rs. 15·15 per ton in 1956-57 *i.e.* by 15·6%.

Pit-head Costs Plus Freight.

Taking pit-head costs and freight charges together, the percentage increases in each of the five years over 1952-53 for loco and non-loco coal are given in table 14.

TABLE 14.—*Pit-head Costs plus Freight—1952-53 to 1956-57*

Year	Loco		Non-loco		Total	
	Pit-head costs plus freight charges (in millions of Rs.)	Percentage increase (+)/decrease (—) over 1952-53	Pit head costs plus freight charges (in millions of Rs.)	Percentage increase (+)/decrease (—) over 1952-53	Pit-head costs plus freight charges (in millions of Rs.)	Percentage increase (+)/decrease (—) over 1952-53
1952-53 . . .	292·2	..	28·6	..	320·8	..
1953-54 . . .	294·0	+0·6	31·1	+8·6	325·1	+1·3
1954-55 . . .	316·7	+8·4	31·8	+11·4	348·5	+8·7
1955-56 . . .	344·0	+17·7	31·6	+10·6	375·6	+17·1
1956-57 . . .	404·0	+38·3	37·6	+31·7	441·6	+37·7

The increase in expenditure on coal (excluding handling and incidental charges) in 1956-57 as compared to 1952-53 has been due to (1) increase in pit-head costs, and (2) increase in freight charges. The increase in pit-head and freight charges can be further sub-divided under (a) increase due to rise in pit-head prices and freight rates and (b) increase due to extra quantity of coal consumed. The break-up of the percentage increase of 38·3% in the expenditure on loco coal, 31·7% on non-loco coal and 37·7% overall due to each factor is given in Table 15:—

TABLE 15--*Break-up of Increase in Expenditure on Coal in 1956-57 as compared to 1952-53.*

	Loco %	Non-loco %	Total %
(1) Increase in pit-head costs :			
(a) due to rise in pit-head prices	9·7	9·8	9·7
(b) due to increase in the quantity consumed	10·7	9·3	10·6
and			
(2) Increase in freight charges :			
(a) due to rise in freight rates	8·8	5·8	8·5
(b) due to increase in the quantity consumed	9·1	6·8	8·9
Total Increase	<u>38·3</u>	<u>31·7</u>	<u>37·7</u>

It will thus be observed that out of the overall increase of 37·7%, increase due to extra quantity of coal consumed is 19·5% [*i.e.* 1(b)+2(b)] and due to rise in pit-head prices and freight rates 18·2% [*i.e.* 1(a)+2(a)].

Handling Charges.

Regarding handling of coal, which comprises mainly unloading from wagons, stacking, and loading on engine tenders, the cost incurred by the various Railways is indicated in Appendix 3. The costs during the three years 1954-55 to 1956-57 for which figures are readily available are shown in table 16.

TABLE 16—*Handling Costs*

Year	Total pit-head and freight charges (in millions of Rs.)	Hand- ling costs (in millions of Rs.)	Percentage of Col. (3) to Col. (2)	Handling costs per ton Rs.
1	2	3	4	5
1954-55	348·5	9·6	2·8	0·9
1955-56	375·6	10·5	2·8	0·9
1956-57	441·6	11·7	2·6	1·0

It will be seen that the handling costs did not vary significantly and were about 2·7% of the pit-head cost-*cum*-freight charges during these years.

Incidental Costs.

The incidental costs on coal, are given in Appendix 4 for the 3 years for which figures are readily available. These comprise sales tax, excise duties and transhipment charges at break-of-gauge junctions and at docks. The incidental costs for the three years are given in table 17.

TABLE 17—*Incidental Costs*

Year	Total Pit-head and freight charges (in millions of Rs.)	Incidental costs (in millions of Rs.)	Percentage of Col. (3) to Col. (2)	Incidental costs per ton of coal received (in Rs.)
1	2	3	4	5
1954-55	348·5	16·6	4·8	1·4
1955-56	375·6	17·4	4·6	1·4
1956-57	441·6	17·2	3·9	1·3

These costs on an average amount to about 4·4% of total pit-costs plus freight charges.

17. The analysis given above is summarised in table 18 below :—

TABLE 18—*Summary of Analysis*

Factors	Additional expenditure incurred in 1956-57 as compared to 1952-53 (in millions of Rs.)	Percentage of col. (2) to expenditure on coal (pit-head plus freight charges) in 1952-53
(1)	(2)	(3)
<i>Increase in pithead costs</i>		
(1) Due to rise in pithead prices	31	9·7
(2) Due to increase in quantity of coal consumed	34	10·6
<i>Increase in freight charges</i>		
(3) Due to rise in freight rates	27	8·5
(4) Due to increase in quantity of coal consumed	29	8·9
	121	37·7
(5) Handling charges	3*	1·0
(6) Incidental costs	3*	1·0

*Approximate.

Thus, out of the increase of about Rs. 121 millions in the expenditure on coal (excluding handling and incidental charges) in 1956-57 as compared to 1952-53, about Rs. 58 millions is due to increase in pit-head prices and freight charges and the balance of Rs. 63 millions is due to increase in consumption.

The increase in pit-head prices and freight rates is due mainly to higher working costs including higher wages, and over these factors Railways have little control. It is, however, relevant to reiterate that rational fixation of coal prices for the various grades of coal is a matter of importance to the Railways as the largest consumer, and that the present price structure penalises consumers of non-coking coals. Thus, until the price structure is rationalised, the Railways will necessarily incur higher and higher costs on non-coking coals, which after the next few years will represent their entire supplies.

The factors responsible for increase in consumption are discussed in Chapters III, IV & V.

CHAPTER III

EFFECT OF QUALITY OF COAL ON CONSUMPTION AND COSTS

Quality of
Coals Pro-
duced.

18. Prior to World War I, the coal produced in India was obtained chiefly from the well-known good quality seams of the Raniganj and Jharia Coalfields. The average ash did not exceed 13%. With the increased demands for coal during the First World War, a large number of mines came into existence, many of them raising small quantities of coal from comparatively shallow seams, and there was no doubt some increase in the average ash during the early twenties.

Then followed a period of about 10 years during which the coal industry suffered seriously. Prices of coal steadily dropped from Rs. 4/13/- in 1926 to Rs. 2/12/- in 1936 and during the period of world economic depression in the early thirties, production also fell from 23·8 million tons in 1930 to 19·8 million tons in 1933. Reduction in prices led to increased demand for good quality coal and gave rise to cut-throat competition. The collieries, faced with struggle for existence, met the demands of good quality coals by mining coal in the better sections of the seams (selective mining), and by economising in the provision and maintenance of mining plant and equipment.

With the advent of World War II, the demands grew rapidly and the coal industry had a boom in prices as the demands outstripped production. With a view to stepping up production and stabilising prices of coal, the Government of India took over control of production, distribution and prices of coal. In 1944 the Colliery Control Order was issued and it prohibited selective mining—which not only removes the best coal from a seam but also adversely affects the workable reserves of coal. Restriction of selective mining resulted in higher average ash in the coal marketed. By the year 1945 the average ash had probably risen to a figure above 20%. There has been a progressive decline in the quality of coals produced and supplied in the country, and the Coal Washeries Committee (1954) summed up the reasons for deterioration in quality as follows :—

- (a) exhaustion of superior quality of coal seams and increased production from inferior seams ;
- (b) deterioration in quality due to more coal being obtained by depillaring, whereas previously most of the coal was obtained by selective mining in the development stage ;
- (c) deterioration in quality of many seams with increasing depth of mines ;
- (d) increase in the number of small collieries mining inferior coal—which is profitable due to the unbalanced price structure in force ;
- (e) loading of inferior coal due to slackness in inspection to ensure that the coal loaded was according to grade ;
- (f) creation of market for inferior coal.

Effect of Ash
on Coal Con-
sumption in
Locomotives.

19. The behaviour of coal in a locomotive is influenced by the quality and amount of 'ash' as well as by the coking or non-coking property of the coal. If ash is easily fusible excessive clinkering results, and such coals are quite unsuitable for loco use. Even if the 'ash' does

not produce clinker it interferes with the process of combustion : the higher the ash in coal the more difficult it is to ensure contact of the oxygen of the air with the solid combustible constituent (fixed carbon) of coal, and the poorer is the combustion efficiency. Coking coals on heating in the furnace tend to cake and coalesce : they burn largely on the fire-grate except for the volatiles but these are not excessive in quantity. On the other hand, non-coking coals tend to splinter and break into small size on heating and thus burn (to some extent) in the furnace space above the fire-bed. The result is that a certain amount of non-coking coal passes out of the chimney in an incompletely burnt state. Moreover, they liberate larger quantities of volatiles than do coking coals and require larger furnace proportions for their efficient combustion. The furnace proportions of locomotives being restricted, the locomotive boiler gives higher efficiency with coking coal than with non-coking coal.

Extensive trials have been carried out on Indian Railways with different types of locomotives in use, *viz.*, old BESA (British Engineering Standard Association design), earlier IRS (Indian Railway Standards design) locomotives and the new IRS locomotives on different services. The earlier BESA and IRS locomotives have smaller furnace proportions as compared to the new IRS locomotives. The results given in table 19 show that :—

- (i) the coal consumption rate increases far more rapidly than the increase in the percentage of 'ash' or 'ash plus moisture' in coal ; and
- (ii) such increase in consumption of coal is most marked in the case of BESA and earlier IRS locomotives which were designed for burning coking (low volatile) coals.

TABLE 19.—*Consumption of Coking and Non-Coking Coals in Indian Locomotives performing Same Services.*

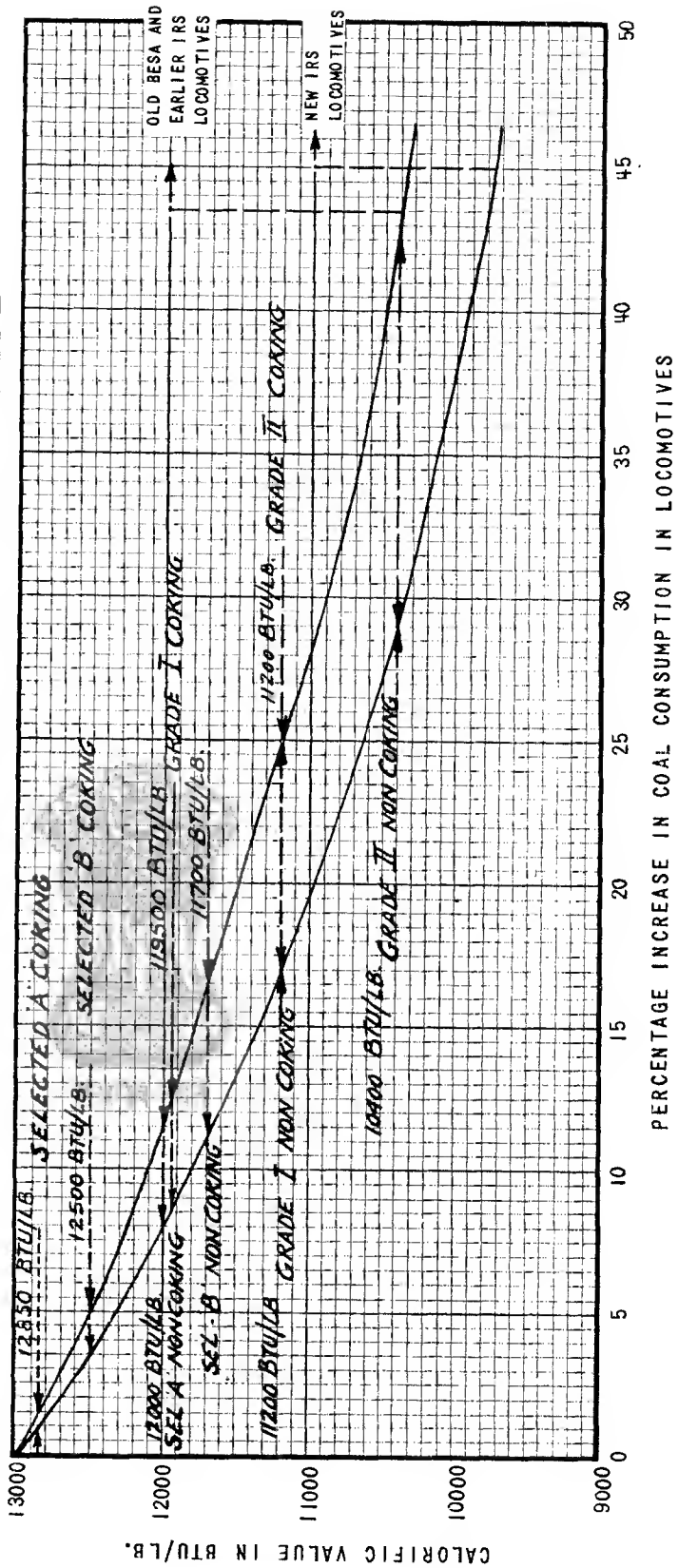
Grade of coal	Low volatile coking coals				High volatile non-coking coals			
	Calorific value Btu/lb	Ash Percentage	Relative coal consumption		Calorific value Btu/lb	Ash plus moisture Percentage	Relative coal consumption	
			New IRS locos	Old BESA & earlier IRS locos			New IRS locos	Old BESA & earlier IRS locos
Sel. A	13000* 12850	Upto 15	101.0	101.5	12000	Upto 17.5	108.0	111.5
Sel. B	12500	15 to 17	103.5	105.0	11700	17.5 to 19	111.0	116.5
Gr. I	11950	17 to 20	108.5	112.5	11200	19 to 24	117.0	125.0
Gr. II	11200	20 to 24	117.0	125.0	10400	24 to 28	129.0	142.5

*Pre-war standard selected quality coal having an average calorific value of 13000 Btu/lb has been given a coal consumption index of 100.

A general relationship between the calorific value of coal and percentage increase in coal consumption based on the performance data is presented in graph V at page 25.

GRAPH V - RELATIONSHIP BETWEEN CALORIFIC VALUE & PERCENTAGE INCREASE IN COAL CONSUMPTION IN LOCOMOTIVES

GRADE OF COAL	LOW VOLATILE COKING COALS		HIGH VOLATILE NON-COKING COALS	
	CALORIFIC VALUE BTU/LB.	PERCENTAGE INCREASE IN COAL CONSUMPTION NEW IRS LOCOS OLD BESA & EARLIER IRS LOCOS	CALORIFIC VALUE BTU/LB.	PERCENTAGE INCREASE IN COAL CONSUMPTION NEW IRS LOCOS OLD BESA & EARLIER IRS LOCOS
SELECTED 'A'	12850	1.0%	12000	8.0%
SELECTED 'B'	12500	3.5%	11700	11.0%
GRADE I	11950	8.5%	11200	17.0%
GRADE II	11200	17.0%	10400	29.0%



While in stationary boilers, consumption of coal has been found to increase by about 1·5% for every 1% increase in ash, table 19 shows that the increase in the case of locomotive boilers is about 2 to 2·5% for every 1% increase in ash. This is because loco boilers are mobile steam generating units with restricted space and weight, requiring high rate of heat release under service conditions. Unlike the old designs of the BESA and earlier IRS locomotives, the new IRS locomotives provide more liberal furnace proportions, but due to space and other limitations the proportions used in stationary boiler plants cannot be attained. This is the main reason why locomotive boilers are more sensitive to 'ash' in coal than are stationary boilers.

Number of Collieries Supplying Coal to Railways.

20. Before the Colliery Control Order (1944) came into force, Railways used to obtain nearly one-third of their requirements from State-owned collieries and the balance from private-owned collieries by inviting tenders. The entire railway requirements were met from a small number of collieries. The number of collieries supplying coal to Railways, however, increased rapidly with the allocation of railway coal orders by the Coal Controller on the basis of the output of individual collieries. In 1939-40, coal requirements of all the Indian Railways were met from about 125 collieries and the total quantity of coal supplied was about 8 million tons. After 1944 the number of collieries supplying coal increased progressively and in the last decade it has risen to about 550, *i.e.*, by 400%, although coal consumption has risen only to 13·2 million tons, *i.e.*, by 65%. Table 20 shows the number of collieries that have supplied coal to the Railways during the last few years (See also Appendix 5).

TABLE 20.—*Total Number of Collieries that have supplied coal to Railways during 1954-55 to 1956-57*

Railway	1939-40	1954-55	1955-56	1956-57
Central	125	198	191	234
Eastern		218	324	435
Northern		232	141	146
North Eastern		235	182	256
South Eastern		76	82	81
Southern		*	*	*
Western		140	141	124

*Figures not maintained due to bulk supplies by sea.

Further, Appendix 6 gives the maximum, minimum and monthly average number of collieries supplying coal to individual sheds of Railways during the year 1956-57. These figures show that in a monthly period as many as 70 to 100 collieries supplied coal to each major shed.

Adverse Effects

21. The adverse effects of supplies from a large number of collieries are :

(1) *Widely varying sources.*—It has not been possible to keep in separate stacks the supplies of coal from widely varying sources and this has resulted in the mixing of numerous coals of different combustion characteristics. The mixing of coals in stacks (unlike uniform blending in mechanical plants) has been responsible for inconsistency in quality. This has adversely affected combustion conditions in locomotives and caused excessive consumption of coal as the boiler draft cannot be satisfactorily set for mixtures of widely varying quality.

(2) *Smalls and Dust*.—The larger the number of collieries the more difficult is Inspection, and much small coal has found its way into railway supplies. Excess of 'smalls and dust' mixed with coal causes considerable loss of partially burnt coal. The results of trials (1951-52) carried out on locomotives with coals containing different quantities of small and dust are reproduced in table 21.

TABLE 21.—*Increase in Consumption with Increases in Small and Dust*

Coal used	Consumption Units	
	Non-coking Coal	Coking Coal
Coal with 5% 'Small and dust'	100·0	100·0
Coal with 10% 'Small and dust'	100·8	100·3
Coal with 15% 'Small and dust'	102·1	100·9
Coal with 20% 'Small and dust'	103·6	101·8
Coal with 25% 'Small and dust'	105·6	102·8
Coal with 30% 'Small and dust'	108·0	104·0

Complaints made by Railways particularly during the last one year indicate that nearly one-third of the supplies contain excessive quantity of 'smalls and dust' ranging from 25 to 35% and in some cases even more. Taking the 'smalls and dust' to be 25% in such supplies, the increase in consumption would be about 1·5% of the total supplies.

(3) *Inadequate control on quality*.—With the large number of collieries supplying coal to Railways, inspection has become increasingly difficult. As a result, the Railways have continued to receive coal of inferior quality. This condition has also arisen from the method of loading in the mines and the subsequent neglect of proper hand-picking at the surface. As loading of miscellaneous coal and dirt is being increasingly practised in the mines, increased hand-picking at the surface is essential : such picking can be done efficiently only if a travelling picking belt is installed.

First Rapid Quality Survey.

22. In order to obtain precise information regarding the quality of coal supplied to Railways, a 'Rapid Quality Survey' was carried out on each Railway during the month of September 1957. The quality survey was made in the following manner :—

- (a) drawing samples of coal in major selected sheds at the rate of one sample for every 500 tons of coal received, and
- (b) testing the samples in the laboratory to determine 'ash' and 'moisture' to indicate the grade of coal actually found on test.

Details of the quality survey are given in Appendix 7(a). Analysis of the gradewise results of the 'Rapid Quality Survey' relating to supplies from Bengal and Bihar Fields is given in tables A to D of this Appendix.

The results are summarised in table 22.

TABLE 22—Comparison of Specified and Actual Grades of Coal received from Bengal & Bihar Coalfields. (September 1957)

As specified	As supplied				
	Above correct grade	Correct grade	One grade below	Two grades below	More than two grades below
Selected A	..	37·90%	25·75%	15·15%	21·20%
Selected B	13·75%	18·15%	32·50%	23·73%	11·87%
Grade I	18·82%	25·60%	32·39%	22·22%	0·97%
Grade II	30·00%	30·00%	36·67%	3·33%	..

As the consumption is related to quality as indicated in table 19, the supply of coals below specified grades has resulted in increased consumption. On the basis of yearly consumption, it is estimated that deterioration in quality increased the fuel bill of Railways by Rs. 4·16 crores during the year 1956-57. The increase in expenditure relating to supplies from Bengal and Bihar Fields only is given in table E of Appendix 7(a).

Second Rapid Quality Survey

23. The Committee conducted a Second Rapid Quality Survey during the month of January 1958. The details of the second Survey relating to supplies from Bengal and Bihar Fields are given in Appendix 7(b).

The results are summarised in table 23.

TABLE 23 - Comparison of Specified and Actual Grades of Coal received from Bengal & Bihar Coalfields (January 1958)

As specified	As supplied				
	Above correct grade	Correct grade	One grade below	Two grades below	More than two grades below
Selected A	..	48·48%	12·12%	25·76%	13·64%
Selected B	15·21%	21·74%	28·82%	22·82%	11·41%
Grade I	27·13%	22·34%	23·41%	25·52%	1·60%
Grade II	28·57%	39·29%	32·14%	..	..

It will be seen that the results of the Second Survey confirm the trend disclosed by the First Survey. The extra annual expenditure on account of deterioration of Bengal and Bihar coals was Rs. 3·99 crores against Rs. 4·16 crores indicated by the First Survey.

Increased Expenditure due to Inferior Coal

24. The results of the two 'Rapid Quality Surveys', based on more than 900 tests indicate that inferior quality of coal supplied to Railways (*i.e.* supplies inferior to specified grades) involves the public exchequer in considerable additional expenditure. Assuming that supplies in pre-war years conformed to specifications, the surveys show that there is an increase in consumption of coal of about 11% caused by deterioration in quality of Bengal and Bihar coals which account for 70% of the Railway supplies. This figure of 11% would be higher if the effect of increased percentage of 'smalls and dust' is taken into account and if the results of the fall in quality of coals from the Outlying Fields had been included. The extra expenditure to Railways on account of inferior supplies from Bengal and Bihar Fields alone is of the order of Rs. 4 crores per annum.

One of us, Shri P.M. Nayak, wishes to make the following observation :—

“Without questioning the correctness of the results of the two rapid quality surveys, I feel that the number of samples taken is inadequate to justify generalisation about the quality of the whole volume of supplies received by the Railways. It is also not valid, in my opinion, to proceed on the basis of the conclusions to evaluate the additional expenditure borne by the Railways, as has been done in Table E of Appendix 7(a) and of 7(b). In short, the extension of the results of the rapid quality surveys to the whole of the railway supplies does not seem to be justified statistically.”

25. The rapid quality surveys conducted by the Committee show wide variation between the specified and actually supplied grades of Bengal & Bihar coal. The coals mined now do not conform to the grades fixed on the basis of the grading tests carried out about 10 years ago, as the quality of the coal in the seams mined and the methods of mining and raising coal during the past decade have altered.

The Railways receive nearly 30 per cent of the supplies from Outlying Fields, and the rapid quality surveys carried out on these coals [See Tables A and B of Appendix 7(c)] show that supplies vary widely in quality, about 35 % conforming to Grade I, 20% to Grade II and the balance to lower grades. This wide variation in quality points to the need for grading these coals.

Conclusion.

26. The conclusion is irresistible that the supplies of coal are not up to the specified grade. The need for ensuring that the supplies conform to specifications is urgent. This may be achieved, to a large extent, by

- (i) tightening up quality checks at the loading points;
- (ii) giving Railways freedom to select collieries from which to draw supplies;
- (iii) prompt imposition of penalties on collieries supplying inferior coal.

The present Inspection Organisation under the Coal Controller consists of a Coal Superintendent, 7 Assistant Coal Superintendents (each in charge of a Division) and 26 Loading Inspectors, which is wholly inadequate to exercise a proper check on about 550 loading points. Apart from the question of inspection costs, the dearth of properly qualified and trained personnel would preclude the development of an organisation to carry out effective inspection at about 550 loading points. In view of the gravity of the problem, it is considered that a substantial reduction in the number of collieries supplying coal to Railways is necessary to permit proper inspection at the loading points. Moreover, the inspection should be carried out by Railways who should set up a Field Organisation for the purpose. It would also be advantageous for the Railways to obtain their supplies by entering into contract with collieries and the contract should provide for penalties enforceable by the Railways for failure to supply coal according to grade.

One of us, Shri P.M. Nayak, wishes to make the following observation:—

“ In my opinion, the quality of coals received by the Railways is susceptible of considerable improvement by better inspection and check at the loading points. I recognise that inspection of loco coal by the Organisation of the Coal Superintendent, Dhanbad, has been inadequate in recent years. This is solely

due to inadequacy of staff. Proposals for expanding the staff have not been proceeded with pending the taking over of the inspection functions by the Railways. It is my belief that with a properly constituted and adequate Inspection Organisation working in the coalfields a material improvement in the quality of the coals received by the Railways is possible. The other line of improvement lies in progressively reducing the number of collieries from which Railways draw their supplies”.

Recommendations.

27. In view of the increase in annual expenditure arising from inferior quality of coal which amounts to about Rs. 4 crores in the case of Bengal and Bihar Coalfields, the Committee recommend that:—

- (A) The number of collieries from which coal for the Railways is drawn should be progressively reduced to facilitate inspection and control of quality. The target number to be achieved eventually may be taken as 250.
- (B) As loading of miscellaneous coal and dirt is now practised underground in the mines, it is essential that travelling picking belts should be provided on the surface to ensure efficient hand-picking of shale and dirt and loading of coal to specified grades.
- (C) The Railways on their part should take immediate steps to set up an organisation for inspection of Railway Coal with a view to ensuring that the supplies are according to declared grades. The establishment of such an organisation is all the more urgent because the Railways will have to accept more and more non-coking coals in place of coking coals and the maintenance of quality is vital.
- (D) Railways should obtain their supplies by entering into contract with collieries and the contract should provide for penalties enforceable by Railways for failure to supply coal according to grade.
- (E) Coal quality surveys should be conducted twice a year by Railways, preferably in collaboration with Central Fuel Research Institute.
- (F) The coals of Outlying Fields should be graded and suitably priced without any delay.
- (G) The present grading of Bengal & Bihar coals, which is now over ten years old, should be revised.

CHAPTER IV

OTHER FACTORS AFFECTING COAL CONSUMPTION

28. The effect of the quality of coal on consumption and costs has been discussed in Chapter III. In addition to the quality of coal, there are other factors which affect coal consumption, such as the volume of traffic, the operating conditions, and coal losses and wastages.

Volume of Traffic

29. The total quantity of coal consumed is naturally affected by variation in the volume of traffic. Under normal conditions, coal consumption should closely follow the volume of traffic moved (in gross ton miles). The relationship between the gross ton miles index and the coal consumption index is clearly brought out in graph IV at page 18, which shows that the consumption index closely followed the traffic index (gross ton miles) from 1926-27 to 1940-41. Thereafter, under the impact of the abnormal conditions created by the war and later by the Partition of the country, the coal consumption index moved upwards more rapidly than the traffic index up to 1948-49. As conditions returned to normal the gap between these two indices stopped widening and has shown signs of narrowing down since 1953-54. (See graph VI at page 32).

As the period 1938-39 to 1951-52 was influenced by the war, by political changes, and by regrouping of Railways, an examination of the performance trends with respect to these years is of little use. The present trends can be judged more clearly from the performance since 1952-53, and the Committee has therefore examined the consumption trends with reference to the volume of traffic during the period 1952-53 to 1956-57. The percentage increases in gross ton miles and tons of coal consumed in 1956-57 as compared to 1952-53 are given in table 24. These have been extracted from Appendix 8.

TABLE 24: *Relative Increase in Volume of Traffic and Coal Consumed in 1956-57 over 1952-53*

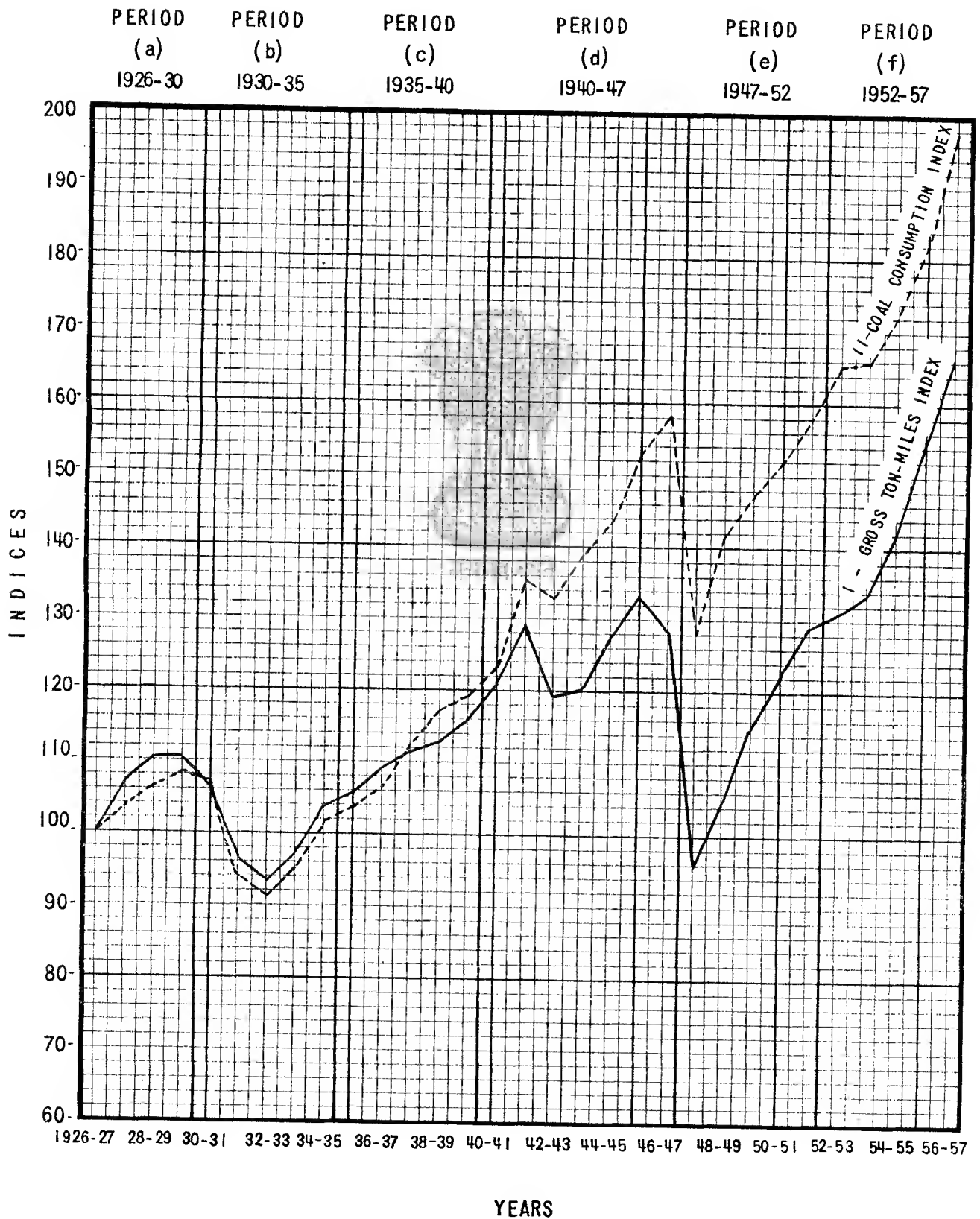
	Passenger & proportion of mixed services			Goods & proportion of mixed services			Overall increase for both gauges
	BG	MG	Overall	BG	MG	Overall	
Gross Ton Miles .	15.0%	20.4%	16.3%	32.9%	35.4%	33.3%	26.9%
Quantity of coal consumed .	14.4%	15.4%	14.6%	21.5%	20.4%	21.3%	18.6%

It will be observed that in the case of passenger services, there is a close correspondence between the increase in traffic and coal consumption, but in the case of goods services the increase in coal consumption is comparatively lower than the increase in traffic. For the overall percentage increase of 26.9 in gross ton miles the increase in the coal consumed has been only 18.6%, indicating an improvement in fuel utilisation during these five years.

Other Factors Affecting Coal Consumption

30. The efficiency in the use of coal on Railways is determined by the consumption rate in lb. per 1000 gross ton miles. This yard stick enables

GRAPH VI - INDICES OF GROSS TON MILES & COAL CONSUMPTION
DURING THE PERIOD 1926-27 to 1956-57.



an examination of the performance of Railways independently of the variations in the volume of traffic. Besides the quality of coal, the operating factors which affect the consumption rate in lb. per 1000 gross ton miles are :—

- (1) utilisation of locomotives (engine hours in steam).
- (2) trailed load in relation to locomotive weight.
- (3) thermal efficiency of locomotives.
- (4) wastages arising from poor firing technique and locomotive maintenance and losses arising from thefts or pilferage.

The effect of each of these factors on the consumption rate is discussed in the following paragraphs.

Utilisation of Locomotives (Engine Hours in Steam)

31. In train operation, engine hours spent in moving trains (including train halts) are termed 'train engine hours'. Under stable operating conditions, the increase or decrease in 'train engine hours' should correspond to the increase or decrease in train miles. In addition to the time spent in moving trains, locomotives stand idle in yards or move light, unattached to trains. The engine hours so spent are termed 'other engine hours.' Normally, the increase or decrease in 'other engine hours' should also follow the increase or decrease in train miles.

As the steam locomotive continues to consume coal even when it is idling, coal consumption would rise if the total engine hours required for moving a given volume of traffic increase. A disproportionate increase in engine hours will therefore affect the consumption rate in lb. per 1000 gross ton miles adversely.

By comparing the engine hours in steam and train miles for the year 1952-53 with those of 1956-57, it is possible to ascertain whether the increase in engine hours has been proportional to the increase in train miles over this period. These figures are presented in Appendix 8; the percentage increases in 1956-57 over 1952-53 are given in table 25.

TABLE 25: *Relative Increase in Train Miles and Engine Hours*

	Passenger & proportion of mixed services			Goods & proportion of mixed services			Overall increase for both gauges
	BG	MG	Overall	BG	MG	Overall	
	%	%	%	%	%	%	%
Train Miles	10.3	11.5	10.8	18.2	12.1	16.5	13.2
Train Engine hours	12.8	11.7	12.3	28.2	24.2	27.0	20.8
Other Engine hours	16.9	9.0	14.0	21.2	21.4	21.2	19.6
Total Engine hours	14.3	10.9	12.9	24.2	22.8	23.8	20.2

It will be observed that the overall increase in train miles has been 13.2% while the engine hours have increased by 20.2%. The increase in engine hours has no doubt been due to heavier train loads (resulting in slower movement) and also to the rapid increase in traffic leading to saturation conditions on busy sections, and consequently to longer journey time. The fact, however, remains that the engine hours have increased more rapidly than the train miles and it is reasonable to conclude that this factor has adversely affected coal consumption during the five-year period under review.

**Trailed Load
in Relation to
Locomotive
Weight.**

32. For a given weight of locomotive, the consumption rate in lb. per 1000 gross ton miles is affected by the load hauled. Although the increase in load tends to increase the quantity of coal consumed, the rate of consumption in lb. per 1000 gross ton miles gradually falls, as the coal consumed in moving the locomotive itself remains constant. Thus with a light load the consumption rate is higher than with a heavy load.

For example, dynamometer car trials with W G locomotives hauling different loads show that the consumption rates fall with increasing load as in table 26.

TABLE 26:—*Relation between Load and Coal Consumption Rate for W G Locomotives.*

Train Load	Consumption in lb. per 1000 G.T.M.	
	Level Track	Gradient 1 in 200 Up
1000	92	205
1200	85	195
1400	79	180
1600	75	—
1800	72	—

It is, however important to remember that this reduction in the consumption rate can be effected only if the engine weight remains unaltered while load is increased. If the engine weight increases in the same proportion as the trailed load, the consumption rate would remain more or less the same. In other words, the consumption rate can be lowered by hauling heavier loads with the same engine up to its optimum tractive capacity, but if larger engines are used to haul correspondingly larger loads, the consumption rate may not improve.

A comparison of the average trailed load with the average locomotive weight is therefore of interest. Both these figures have increased during the five-year period 1952-53 to 1956-57, as will be seen from Appendix 8. For instance, the average weight of B.G. passenger locomotives has increased from 113 tons to 120 tons or by 6·2%. On the other hand, the average trailed load of B. G. passenger services has increased from 354 tons to 367 tons or by 3·7%. Similarly, the average weight of B.G. goods locomotives has increased from 131 tons to 143 tons or by 9·2% and the average trailed load from 910 tons to 1027 tons or by 12·9%. The relative increases in 1956-57 over 1952-53 are given in table 27.

TABLE 27:—*Relative Increase in Trailed Loads and Weights of Locomotives in 1956-57 as compared to 1952-53.*

	Passenger and proportion of mixed			Goods and proportion of mixed			All Services combined		
	BG	MG	Overall	BG	MG	Overall	BG	MG	Overall
	%	%	%	%	%	%	%	%	%
Average trailed load	3·7	7·8	4·4	12·9	23·1	15·3	11·8	16·4	13·2
Average weight of the locomotive	6·2	7·7	7·4	9·2	8·6	8·8	8·3	7·5	6·7

It will be seen that so far as passenger services are concerned, the average weight of locomotives has increased faster than the average trailed load ; but in the case of goods services, the average trailed load has increased faster than the average engine weight. Taking all services together, trailed load has increased by 13·2% and the average weight of locomotives by 6·7%. Thus, while passenger services may have contributed to an increase in consumption of coal, the goods services will have more than offset the increase resulting in an overall decrease in consumption rate on this score.

Thermal Efficiency of Locomotives

33. In steam locomotives the heat energy of coal is converted into useful mechanical energy for hauling loads. The ratio of the useful mechanical energy to the heat energy of coal is termed as the thermal efficiency of the locomotive. The rate of consumption of coal in lb. per 1000 Gross Ton Miles is directly proportional to the thermal efficiency, if other factors remain unchanged.

The new I R S engines (e.g. W P & W G) introduced after 1947 have a thermal efficiency of about 6·4% as compared to a thermal efficiency of 4·7% to 5·2% (average 5%) for the older types. With the progressive increase in the number of new locomotives, there will naturally be an increase in the average thermal efficiency of the locomotive fleet on Railways. The proportion of new and old locomotives on Railways is brought out in Appendix 9, which gives the number of B.G. and M.G. locomotives in various age groups for the years 1952-53 to 1956-57. In 1952-53, engines of the 0-5 years age-group can be taken as new engines of higher thermal efficiency. In 1956-57, engines of the 0-10 years age-group can be taken as new engines of the higher thermal efficiency. The relative percentages of the new and the old engines for the years 1952-53 and 1956-57 are given in table 28.

TABLE 28:—Percentages of New and Older Engines.

	1952-53			1956-57		
	New	Old	Average Thermal Efficiency	New	Old	Average Thermal Efficiency
	%	%	%	%	%	%
Broad Gauge	17·2	82·8	5·24	38·6	61·4	5·54
Metre Gauge	19·0	81·0	5·27	38·3	61·7	5·54

Thus, the proportion of new locomotives has increased by about 20% during the period of five years. This has contributed to an increase in the average thermal efficiency from 5·25% to 5·54%. As the consumption rate is proportional to the thermal efficiency of locomotives, it may be concluded that the consumption rate will have fallen by about 5% due to the increase in thermal efficiency.

Wastages & Losses.

34. The operating factors discussed above result largely from progressive development of traffic and new locomotive designs and are not much influenced by the human factor in the day to day working of the locomotive. The losses and wastages, however, are largely governed by the standards of skill and experience of Railway running and maintenance staff, and the general level of integrity of both employees and the public. Losses of coal occur due to pilferage from wagons in transit from collieries to sheds, from shed premises themselves, and also from the tenders of locomotives

on the line. Wastages occur in operation due to inefficient firing and unsatisfactory locomotive maintenance. Wastages also occur in sheds for want of adequate control on coal consumption on engines while in shed.

Unfortunately, the effect of the elements giving rise to losses and wastages in shed and line working cannot be determined individually, as their number is so large and the effect of each is so variable, that reliable data cannot be collected for each element separately. It is, however, possible at a particular time to assess approximately the overall magnitude of 'losses and wastages' by carrying out controlled trials. Such trials have been carried out by the Committee to indicate the present position, but as no such trials were conducted in the past, it is not possible to compare the present performance with that obtaining in previous years. A detailed examination of the various aspects of 'losses and wastages' of coal has been made in Chapter V.

Trends in Consumption Rate

35. The cumulative effect of all the factors discussed above on performance is of course reflected in the coal consumption rate (in lb. per 1000 gross ton miles) in different years. The trends in the coal consumption rate for the years 1926-27 to 1956-57 for passenger and goods services on B.G. and M.G. systems are shown in graph VII at page 37.

It will be observed that, in spite of minor fluctuations, the consumption rates at the end of the first decade (1936-37) were the lowest. Thereafter, the rates increased up to 1943-44, more sharply for goods services. In the next two years (*i.e.* 1944-46) there was a marked drop in the consumption rates, especially for passenger services, as there was a phenomenal upsurge in traffic caused by greater industrial activity for the production of war materials and increase in military traffic. The position was reversed during 1947-49 due to the dislocation of rail transport caused by the Partition of the country, and the migration of experienced running and maintenance staff to Pakistan. The peak consumption rates were reached in 1948-49. Thereafter, there has been a steady fall in the consumption rates.

The consumption rates during the last five years (1952-53 to 1956-57) show the present position and indicate the future trends. The All India figures for these services separately for B.G. and M.G. systems for the years 1952-53 to 1956-57 are shown in table 29.

TABLE 29—Coal Consumption Rates in lb. per 1000 Gross Ton Miles

Service	Year	Broad Gauge		Metre Gauge	
		lb. per 1000 Gross Ton Miles	% age increase (+) / decrease (—) over 1952-53	lb. per 1000 Gross Ton Miles	% age increase (+) / decrease (—) over 1952-53
Passenger and proportion of mixed	1952-53 .	186.3	0	226.8	0
	1953-54 .	182.5	—2.0	225.1	—0.8
	1954-55 .	184.7	—0.9	221.3	—2.4
	1955-56 .	182.0	—2.3	221.0	—2.6
	1956-57 .	185.2	—0.6	218.6	—3.6
Goods and proportion of mixed	1952-53 .	166.5	0	201.3	0
	1953-54 .	163.3	—1.9	202.7	+0.7
	1954-55 .	161.1	—3.2	190.2	—5.5
	1955-56 .	153.8	—7.6	186.8	—7.2
	1956-57 .	152.4	—8.5	178.6	—11.3
Passenger, Mixed and Goods	1952-53 .	173.8	0	214.4	0
	1953-54 .	171.2	—1.5	213.8	—0.3
	1954-55 .	169.1	—2.7	206.4	—3.7
	1955-56 .	162.9	—6.3	203.0	—5.3
	1956-57 .	163.0	—6.2	197.2	—8.0

The overall figures indicate that there has been a progressive decrease in the rates of consumption both on B.G. and M.G. systems during the period 1952-53 to 1956-57. As compared to 1952-53, the decreases in rates of coal consumption are as follows :—

			Decrease %
Passenger and proportion of mixed	}	B. G.	—0.6%
		M. G.	—3.6%
		B.G & M.G combined	—1.4%
Goods and proportion of mixed	}	B. G.	—8.5%
		M. G.	—11.3%
		B.G & M.G. combined	—9.0%
Overall performance for all services.	}	B. G.	—6.2%
		M.G.	—8.0%
		B.G. & M.G. combined	—6.6%

It has already been pointed out that the rate of coal consumption in lb. per 1000 Gross Ton Miles is affected by the following factors :—

- (i) quality of coal.
- (ii) engine utilisation.
- (iii) trailed load in relation to locomotive weight.
- (iv) thermal efficiency of locomotive.
- (v) losses and wastages.

As regards the quality of coal, no survey tests and trials were carried out in 1952-53 and it is thus not possible to measure whether there has been deterioration or improvement in quality in the five years under review.

As regards engine hours, the position has no doubt worsened and the effect on the rate of consumption must be taken as adverse.

Regarding trailed load per ton weight of locomotive, the position has shown improvement, and the effect on coal consumption rate must have been favourable.

Similarly, the improvement in the average thermal efficiency of locomotives must have also had favourable effect.

As regards losses and wastages, here again the effect on coal consumption during the last five years cannot be assessed as no trials were made in 1952-53.

However, the net effect of all the above factors has been a reduction in the rate of coal consumption in lb. per 1000 Gross Ton Miles by 6.6% in the five-year period under review.

Comparison of Pre-war Postwar Periods.

36. Although the coal consumption rates have been steadily dropping since 1948-49, showing a progressive improvement in fuel utilization, they are still higher than the rates obtaining in pre-war years. But a comparison of the present consumption rates with those of pre-war years is not appropriate as the factors affecting them have altered substantially over the past 15 to 20 years as pointed out earlier.

One of the major factors adversely affecting the present consumption rates is the supply of inferior quality of coals. In the pre-war period particularly, not only were better quality of coals available, but supplies were obtained under contract, ensuring supplies to specifications. The rapid quality surveys carried out by the Committee during 1957-58 (c.f. Chapter III) have shown that the inferior quality of coal has been responsible for an 11% increase in the consumption rates.

Further, the train working conditions have gradually become more unfavourable during the post-war years, due to the considerable increase in traffic, leading to saturation of line capacity and therefore to longer engine hours on line. At the present pace of increase in transport and the wide-spread execution of line capacity works, these conditions are not altogether avoidable and their adverse effect on coal consumption is therefore inevitable.

Moreover, during the pre-war period, locomotives were assigned to and operated by nominated crews, which enabled prompt detection and rectification of locomotive defects. Assigned working therefore ensured high standards of locomotive maintenance. The increasing demands of traffic and the rising costs of locomotives since the war have made intensive utilisation of locomotive power necessary. This has resulted in the introduction of locomotive pooling, i.e. operation of a single locomotive by different crews from day to day, and consequently in the loss of personal interest by engine crews in the maintenance of locomotives. Pooling has therefore lowered the standards of locomotive maintenance, thereby increasing coal consumption rates.

Another factor which has materially affected the conditions of locomotive operation and maintenance during the post-war period is the lowering of the standard of skill and experience of both running and maintenance staff, arising from the migration of trained personnel on Partition. Moreover, the rapid increase in traffic and reduction of duty hours of running staff since 1951, under the Adjudicator's Award, necessitated large scale recruitment, resulting in dilution of experienced staff on Railways. In addition, the general standard of discipline has fallen since pre-war years and has affected the efficiency of staff.

Conclusion

37. The above review of the various factors, which have affected consumption of coal has shown that in spite of the handicaps and difficulties experienced, there has been gradual and steady improvement in the utilisation of coal on Railways in the last decade. Steps have been taken by Railways to train their running and maintenance staff and to control consumption of coal by building up their Fuel Organisations, and the results are encouraging. However, it cannot be denied that there is scope for further improvement, particularly by attention to wastages and losses including maintenance. The possibilities of economy in this respect are discussed in detail in Chapter V.

CHAPTER V

LOSSES AND WASTAGES

38. As indicated in Chapter IV, coal consumption is affected by 'losses and wastages'. Losses of coal occur as a result of pilferage from wagons in the course of their movement from mines to sheds, from shed premises, and also from locomotive tenders. Wastages of coal result from inadequate attention to consumption of coal on shed services, firing technique and locomotive maintenance.

In connection with the the determination of 'losses and wastages' of coal, the Committee organised under their direction the following investigations :

- (a) reweighment of coal wagons at colliery base stations with a view to ascertaining whether coals were loaded and despatched according to weights shown in invoices;
- (b) reweighment of coal wagons at major receiving sheds with a view to ascertaining whether any shortages occurred in transit and the extent of shortages found in coal wagons before they reached their destinations; and
- (c) coal trials (at a few major sheds) in which the coal consumption was measured and compared with the consumption recorded in sheds—for the same locomotive operating the same service.

The results of these investigations are briefly discussed in the following paragraphs.

Reweighments at Colliery Base Stations.

39. The data on reweighments of coal wagons at colliery base stations located on the Eastern, South Eastern and Central Railways are furnished in Appendix 10. Reweighments on the Eastern Railway generally show slight overweight ranging from 0.01% to 0.68%. Reweighments on the South Eastern Railway also show overweight in many cases, ranging from 0.05% to 1.7%. On the Central Railway, however, majority of reweighments show underweight ranging from 0.06% to 3.8%, coal wagons reweighed at Bhadrachallam Road (Singareni area) showing marked shortages of 2% to 3.8%. The overall results of reweighments on these Railways are shown in table 30.

TABLE 30.—*Reweighments at Colliery Base Stations*

Base Stations	No. of wagons weighed	Weight in tons	No. with same weight	No. & over weight		No. & under weight		Net result
				No.	Weight (Tons)	No.	Weight (Tons)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Eastern Railway .	530	12,026	118	283	66.9	129	32.75	+0.28
Central Railway .	504	11,303	66	122	51.23	316	166.22	-1.02
South Eastern Railway	376	8,673	59	198	57.28	119	23.14	+0.39

NOTE:—Reweighments were carried out at the following base stations:

Eastern Railway: Ondal, Sitarampur, Kusunda, Bermo, Pathardih.

Central Railway: Junardeo, Wardha, Bhadrachallam Road, Hirdagarh, Belampalli.

S. E. Railway: Bhaga, Mohuda, Bhojudih, Radhanagar, Manendragarh.

It will be observed that, by and large, the reweighments of coal wagons loaded at the base stations do not indicate any shortage in supplies.

**Loss in Transit
(Reweighments
at Sheds)**

40. The results of the reweighments of coal wagons at various sheds undertaken during the months of December 1957 and January 1958 by the Inspectors deputed by the Expert Committee and by the Railways are given in Appendices II(a) & II(b). Summaries of the reweighments are furnished in tables 31, 32, and 33.

TABLE 31.—*Reweighments at Sheds by Committee's Inspectors*

Dec. '57 and Jan. '58

Railway	No. & weight of coal wagons reweighed		Percentage net over or under-weight to total weight of wagons reweighed			
	No.	Tons	Over-weight	Percent-age	Under-weight	Percent-age
			Tons	(+)	Tons	(—)
Eastern . . .	42	948	3.92	0.41	..	..
North-Eastern . .	67	1332	..	..	27.35	2.05
Northern . . .	22	496	..	..	1.70	0.34
Western . . .	61	1394	17.23	1.24	..	..
Central . . .	68	1624	..	..	23.27	1.43
South-Eastern . .	24	540	3.0	0.55	..	..
Southern . . .	62	1392	..	..	47.0	3.38
TOTAL	346	7726	24.15	..	99.32	..
Net					75.17	0.97

TABLE 32.—*Reweighments at sheds by Railways*

December '57

Railway	No. & weight of coal wagons reweighed		Percentage net over or under-weight to total weight of wagons reweighed			
	No.	Tons	Over-weight	Percent-age	Under-weight	Percent-age
			Tons	(+)	Tons	(—)
Eastern . . .	177	4018	..	..	5.45	0.11
North-Eastern . .	34	565	..	..	10.25	1.81
Northern . . .	185	4231	..	..	109.94	2.60
Western . . .	145	3315	7.50	0.23	..	..
Central . . .	108	2400	67.40	3.06	..	..
South-Eastern . .	151	3412	..	..	11.39	0.33
Southern . . .	342	6482	..	..	165.36	2.55
TOTAL	1142	24423	74.90	..	302.39	..
Net					227.49	0.93

TABLE 33.—*Reweighment at Sheds by Railways*

January '58

Railways	No. & weight of coal wagons reweighed		Percentage of net over or under-weight to total weight of wagons reweighed			
	No.	Tons	Over-weight	Precent-age	Under-weight	Precent-age
			Tons	(+)	Tons	(—)
Eastern	124	2806	4.25	0.15	..	..
North-Eastern	16	222	..	..	5.15	2.32
Northern	197	4439	..	..	19.97	0.45
Western	48	1090	..	..	4.05	0.37
Central	74	1719	..	..	19.10	1.11
South-Eastern	94	2121	..	..	27.95	1.32
Southern	158	3054	..	..	35.03	1.15
TOTAL	711	15451	4.25	..	111.25	..
Net					107.00	0.69

It will be observed that the overall shortages disclosed by the test weighments made by the Inspectors deputed by the Committee as well as those made by the Railways are of the same order, viz. 1%.

The Railway Administrations have also furnished the results of reweighments of coal wagons made by them during 1956-57 as per table 34.

TABLE 34.—*Reweighments by Railways during 1956-57*

Railways	No. of wagons received during the year	No. of wagons reweighed during the year	Overall Percentage of wagons reweighed	Total invoiced weights of the wagons reweighed (Tons)	Total weight as per reweighment (Tons)	Shortage discovered (Tons)	Percentage shown in col.(7) vis-a-vis the invoiced weight shown in col 5
1	2	3	4	5	6	7	8
Central	72,223	3,861	5.3	86,143	85,431	712	0.8
Northern	83,117	3,368	4.1	22,589	22,114	475	2.1
Southern	41,169	8,910	21.6	158,383	156,435	1948	1.2
Western (BG)	72,605	240	0.33	5,383	4,988	395	7.3
Eastern	95,000 (approx)	514	0.6	11,644	11,544	100	0.9
TOTAL	364,114	16,893	4.6	284,142	280,512	3630	1.3

Note :—North Eastern & South Eastern Railways do not reweigh coal wagons.

It will thus be observed that, while there are no shortages in the loading of coal at the collieries, an overall shortage of about 1% takes place by the time the wagons reach their destination. This is inspite of the fact that relatively heavy shortages came to light on test weighments at certain sheds such as Jubbulpore, Jhansi and Katni-Marwara sheds on the Central Railway, Kanpur, Delhi-Serai-Rohilla and Jodhpur sheds on the Northern Railway; and Bangalore, Erode and Guntakal sheds on the Southern Railway. Apparently there are heavy pilferages from wagons in transit in these areas. These thefts are often committed from open wagons by habitual offenders when trains slow down on gradients or when they stop at signals, particularly in the proximity of towns having small scale industries.

The Committee consider that periodical reweighment checks at receiving points on Railways should be made to enable the Railways to keep a watch on transit losses and to institute the necessary control measures.

Other Losses
due to Pilfer-
age.

41. In the course of its investigations, the Committee were appraised that in addition to theft or pilferage of coal as such, loss of coal takes place either in the form of half-burnt coal dropped with ashes by the engine crew, or in the form of raw coal broken into small size and mixed with ashes which are removed by staff employed by contractors.

The Committee used the services of Inspectors of the Central Investigation Branch of the Railway Board, who visited *incognito* certain 'black spots' indicated by the Railways. The reports received indicate the prevalence of the following malpractices, particularly in areas which are within the reach of small industries and large towns :—

- (a) thefts of coal from open wagons by habitual offenders when the trains are detained at signals. Such stolen coal is sold to local coal dealers or to small industrial concerns.
- (b) pilferage of coal from coal stacks in the loco sheds, which are not protected by walls or fences. Such thefts are committed by railway employees, whose quarters are located close to the loco yards and by railway contractors' labour, especially where they are allowed to build their hutments along the railway line.
- (c) removal of coal mixed with cinders by the contractors employed for picking cinder and handling ashes in sheds. This malpractice appears to be common where opportunities for removal and disposal of coal (including other Railway materials) exist
- (d) as trip rations are not properly fixed, the engine crew dispose of coal by dropping it from the engine tenders at watering stations or other convenient places for the benefit of interested parties, and also by dropping (during fire cleaning operations) half-burnt coal in loco and traffic yards.

Pilferage of coal is rendered possible as a result of (i) inadequate security arrangements, (ii) insufficient lighting in the yards, (iii) absence of enclosures round the sheds and (iv) ineffective control over trip rations. The situation has been aggravated by the rising costs of coal, the difficult economic conditions, and the development of small industries in towns for which supplies of coal are inadequate. It is a socio-economic evil.

It is difficult, if not impossible, to determine the extent of losses due to pilferage from sheds and from locomotive tenders because the ration for

shed services and line working are at present fixed more or less arbitrarily and pilferage losses are covered in the total consumption of coal on shed and on line.

Shed Wastages.

42. Consumption of coal on shed services varies from 10 to 15% of the total consumption of coal on locomotives. Wastages of coal in sheds arise mainly from :

- (a) long hours in shed movements,
- (b) unduly advanced steaming of engines and their remaining in full steam for long hours due to change in traffic booking.

Control on shed consumption is not effective at present, firstly because consumption on the shed services is not segregated from the figures of coal consumption on train working as tender balances of out-going locomotives are not assessed, and secondly because the assessment of tender balances and issues of coal to locomotives is only approximate. These shortcomings point to the need for proper assessment of the quantity of coal 'left over' on the engine tender on its arrival, and also when it leaves the shed so that the quantity of coal consumed in the shed becomes known. Further, improved calibration of locomotive tenders will ensure reliable assessment of tender balances. Appendix 12 shows a method of calibration which may be considered for adoption.

In the absence of data regarding the total consumption in sheds and the break-up for various stages of servicing, it is not possible at present to estimate the wastages of coal in sheds. Measures necessary to control shed working conditions with a view to minimising wastages are given in Chapter VIII.

Wastages due to Faulty firing/driving Technique.

43. Coal consumption on locomotives in service also depends upon the efficiency of combustion in the fire-box (for generating steam) and on the efficiency of steam utilisation for generating power. The former is controlled by firing technique and the latter by driving technique.

Considerable wastage of coal occurs if the boilers are not properly 'drafted' to suit the quality of coal used, and if the firemen are not trained to follow the correct technique of controlling fire conditions at start, on the run, and when the engines stand idle in sheds or on line. Failure to follow the proper technique results in erratic combustion and blowing of safety valves. The blowing of safety valves results in wastage of 20 to 40 lb. of coal per minute, and if the total duration is 3 minutes per hour, the wastage would amount to 60 to 90 lb. of coal per hour—roughly 2 to 3 per cent of the coal fired. Similarly, heavy smoke (usually caused by inadequate supply of air and heavy firing) may result in a loss of about 10% of the coal fired, and if the aggregate period of smoky fire is of the order of 10 minutes per hour, the loss of coal may amount to 2% of the coal fired.

Some wastage of coal occurs due to uneconomic use of steam by drivers resulting from inexperience and indifferent control over steam auxiliaries.

Here again, an assessment of the wastage of coal due to bad firing and driving cannot be separately made as no data are available for showing separately the effect of these factors on the overall performance.

Wastages due to Mechanical Defects in Locomotives.

44. Locomotives in poor mechanical condition give rise to fuel wastages on account of :

- (a) steam leaks arising from excessive wear of valve and piston rings and glands,

- (b) unsatisfactory valve gear adjustments,
- (c) damaged or 'absent' brick-arch.

Items (a) and (b) together can result in a consumption of about 5% more than that of a locomotive in good mechanical condition. The Committee note that in the case of main line locomotives which are now progressively hauling heavier loads, piston and valve rings are frequently renewed to keep locomotives steam-tight. Excessive wear of piston and valve rings is largely caused by inadequate or inefficient lubrication. To minimise steam losses due to inefficient lubrication, investigations are now being made by the Indian Standards Institution in collaboration with the Railways to frame specifications for steam cylinder oils, particularly for new IRS locomotives (with super-heated steam temperatures as high as 700° F). These specifications need to be finalised without delay.

Item (c) *viz.*, damaged or an 'absent' brick-arch alone may lead to increased consumption of about 10%. Lack of attention to maintenance can thus cause substantial variation in coal consumption. In addition to these major defects, there are a number of minor defects which contribute to wastages such as leaky tubes, steam cocks and joints which require frequent attention.

Wastages arising from mechanical defects in locomotives cannot be separated from those due to other factors affecting consumption of coal.

Coal Trials.

45. From the above examination it would be seen that neither losses by pilferage from shed premises and locomotive tenders, nor wastages arising from poor firing technique or from poor locomotive maintenance can be correctly ascertained. An overall estimate of these losses and wastages can, however, be made by comparing the actual consumption of coal on trials with the consumption of coal recorded by sheds for the same locomotives operating the same services.

The results of coal trials conducted by the Committee, on passenger and goods services, at a few major sheds on different Railways are presented in Appendix 13. They show wide variation between the actual consumption on trial and that recorded by the sheds. It is, however, not reasonable to estimate from these results the losses and wastages on Indian Railways as a whole since the number of trials was small. The range of variation, *viz.* 4% to 18%, indicated by the trials is no doubt disquieting and points to the need for more attention to working conditions in sheds and on line and to firing technique and maintenance of locomotives.

After discussion with the Railway Board, the Committee initiated a scheme of intensive coal trials on Railways, which the Board have agreed to continue under their direction. These large scale trials will pin-point the 'weak spots' and help to control local factors responsible for large variations in coal consumption, which are indicative of 'losses and wastages'.

46. The above review shows that about 1% of the coal despatched to Railways is lost by pilferage from coal wagons in transit from collieries to sheds; that other losses occur due to theft of coal from loco sheds by removal of coal mixed with cinders, and from engine tenders with the connivance of running staff. Further, the wastages in sheds are due to inadequate control over shed working conditions, while those on the line arise from faulty firing technique and mechanical defects in locomotives. Unfortunately, the effect

of each factor cannot be determined separately, but as the cumulative effect of the losses and wastages is reflected in the overall consumption of coal by the locomotives, coal consumption trials will help in assessing the extent of losses and wastages.

In view of the scope for economy disclosed by the coal consumption trials, the Committee consider that steps to control each of the factors responsible for losses and wastages are necessary. These are detailed in Chapter VIII.

Recommendations **47. The Committee recommend the following measures for Assessment of losses and wastages :—**

- (A) **Reweighment checks of coal wagons at receiving sheds should be periodically carried out to keep a watch on transit losses.**
- (B) **The quantity of coal consumed in shed services should be assessed separately from that consumed in train working.**
- (C) **The calibration of locomotive tenders should be improved to enable accurate assessment of tender balances.**
- (D) **The railways should be fully equipped to carry out periodically coal trials for fixing correctly trip rations for various services so that coal consumption on line can be properly checked.**



CHAPTER VI

HANDLING OF COAL AND ASHES—MERITS AND DEMERITS OF CONTRACT AND DEPARTMENT WORKING

48. There are two items of work, for which considerable labour is required. These are—

- (a) handling of coal in loco sheds and pumping stations, and
- (b) handling and disposal of ashes released by locos in sheds, yards and watering stations.

The volume of coal and ash handling work in loco sheds is considerable, whereas at individual pumping and watering stations and also traffic yards, this work is of small magnitude.

The cost of handling of coal and ashes is only 2·7% of the expenditure on coal, but in view of the scope for pilferage in handling, it is necessary to consider closely how best this work should be done, on contract or departmentally.

Handling of Coal

49. Handling of coal in loco sheds involves the following operations :—

- (i) unloading of coal from wagons.
- (ii) stacking (and levelling) of coal unloaded.
- (iii) loading of coal from stacks (or directly from wagons) on engine tenders, mechanically or manually.

There are other items of coal handling for loco and non-loco purposes, such as carrying of coal to stationary boilers and for repair works in sheds etc., but their magnitude is very small.

Quantities handled and Unit Costs of various Operations

50. In Appendix 3 are given the quantities of coal handled, the handling charges incurred on each Railway and the cost per ton for each operation for the years 1954-55 to 1956-57. The all railway summary for the three years is given in table below :—

TABLE 35—Quantities and Costs of Coal Handled and Average Cost per Ton during 1954-55 to 1956-57

Year	Quantities handled				Handling charges incurred on				
	*Qty. un-loaded	Qty. stacked	Loading on tenders		Un-loading	Stacking	Loading on tender		Total
			Manu-ally	Mecha-nically			Manu-ally	Mecha-nically	
(In Million Tons)				(In Million Rupees)					
1954-55	10.26	6.58	5.13	5.37	3.00	0.22	4.40	2.01	9.63
1955-56	11.17	6.75	5.62	5.70	3.62	0.21	4.55	2.10	10.48
1956-57	12.02	7.21	6.15	6.22	4.39	0.26	4.84	2.20	11.69

*This excludes quantity directly loaded on tenders from wagons.

TABLE 35—Quantities and Costs of Coal Handled and Average Cost per Ton during 1954-55 to 1956-57—contd.

Year	Cost per ton (in Rs.)			
	Unloading	Stacking	Loading on tender	
			Manually	Mechanically
1954-55	0.30	0.04	0.85	0.37
1955-56	0.32	0.04	0.81	0.36
1956-57	0.36	0.05	0.79	0.36

It would be observed that unloading and stacking of coal, which is entirely a manual operation, and is carried out on a majority of Railways by contract labour, costs on an average Rs. 0.4 per ton. Loading of coal on engine tenders costs Rs. 0.36 per ton when done mechanically and Rs. 0.84 per ton when done manually.

Lead and Lift.

51. The lead involved in the unloading of coal is small, as wagons are usually so placed in loco sheds that it is possible to unload them directly on to the stacking grounds. The loading operation also does not involve any lead as engines are placed adjacent to stacks from which coal is loaded. The lift of coal, which relates mainly to the loading operation, is of the order of 8 to 10 feet (depending upon B.G. or M.G. locomotives) where manual loading is employed and about 14 feet where loading is done mechanically. The extent of lead and lift does not vary from shed to shed and therefore does not affect the handling costs.

Extension of Mechanical Loading.

52. The lower cost of loading coal on locomotive tenders mechanically, suggests that it may be economical to replace manual by mechanical loading. Based on a first cost of Rs. 1.25 lakhs for a crane, the interest, depreciation, operating and maintenance costs add up to a monthly expenditure of Rs. 1,600. Comparing this expenditure with that incurred for manual loading, it is seen that the replacement of manual by mechanical loading becomes economical when the handling of coal exceeds 70 tons per day in any shed. Out of the 464 sheds on Indian Railways, only 95 are equipped for mechanical loading at present. The number of sheds, which load more than 70 tons per day, is about 135 and it would therefore be economical to extend mechanical loading to at least another 40 sheds.

Handling of Coal on Railways.

53. The coal handling operations in loco sheds are carried out on various Railways as follows :—

Central Railway :

On 5 out of 7 Divisions (Jhansi, Nagpur, Jabalpur, Bhusaval and Secunderabad) all work is done departmentally. On Bombay and Sholapur Divisions, all work is done on contract system.

Eastern Railway :

All items of work are carried out on contract.

North Eastern Railway :

All items of work (including loading of coal into steamers or tugs, directly from the wagons or from jetty, which is a special feature on the North Eastern Railway) are done on contract.

South Eastern Railway :

All items of work are done on contract, except loading of coal on engine tenders at big sheds (where daily loading exceeds 300 tons) which is done departmentally.

Northern Railway :

Unloading and stacking operations are carried out in all sheds by contract labour, except at small sheds like Simla, Barog, Shakurbasti, Meerut City and Nangal Dam. Loading of coal on engine tenders is carried out under contract on five Divisions, viz. Lucknow, Moradabad, Allahabad, Bikaner and Jodhpur and by departmental labour in Delhi and Ferozepore Divisions.

Southern Railway :

The entire work of coal handling is done under contract in 27 sheds ; in 39 sheds unloading and stacking is done on contract and loading on tenders is done departmentally. In the remaining sheds all items are worked departmentally.

Western Railway :

In B.G. sheds unloading and stacking of coal is done on contract, and loading of coal on tenders is done departmentally. In M.G. sheds all items of work are done on contract.

Thus on the Central and Southern Railways, the bulk of the work is done departmentally. On other Railways, most of the operations are undertaken on contract.

**Merits/
Demerit of
Contract vs.
Departmental
Working.**

54. The merits of the contract system for coal handling are :—

- (a) costs of handling under contract system are considerably lower than those incurred under departmental working.
- (b) there is flexibility in the resources of contractors to provide labour at short notice to meet fluctuating requirements.
- (c) less supervision is required on the part of Loco Foremen who are fully occupied with loco maintenance problems.
- (d) labour problems arising from employment of departmental labour, including matters connected with disciplinary action are minimised.

The chief demerit of the contract system is that it allows access to outsiders within shed premises, which is the main factor leading to thefts and leakages of coal and other railway materials.

Extra Expenditure involved in Complete Departmentalisation.

55. The costs of handling coal by contract and by departmental labour for the year 1956-57 as also the estimated additional expenditure involved in case

the work now done on contract is undertaken by departmental labour are shown in table 36 below.

TABLE 36—*Cost of Handling Coal under Contract/Departmental Working.*

(Rupees in thousands)

Railway	Present costs			Costs against col. (2) if present contract work is done departmentally	Extra Expenditure Col. (5)—Col. (2)
	Under contract	Under departmental	Total		
I	2	3	4	5	6
Central	3,70	27,93	31,63	5,21	1,51
Eastern	10,07	..	10,07	25,60	15,53
Northern	9,58	5,80	15,38	18,45	8,87
North Eastern . .	9,13	..	9,13	18,26*	9,13*
South Eastern . .	7,52	1,34	8,86	23,43	15,91
Southern	10,33	7,53	17,86	15,49	5,16
Western	11,95	12,05	24,00	16,73	4,78
TOTAL	62,28	54,65	1,16,93	1,23,17	60,89

*N.E. Railway has not furnished approximate costs under departmental system. The average for other Railways has been adopted.

56. It will be observed that of the total expenditure of Rs. 116.93 lakhs, about half (46.7%) is on departmental handling, and the balance on contract handling. If the work at present done on contract is also departmentalised, the expenditure will increase to Rs. 177.82 lakhs (*i. e.* Rs. 123.17 plus Rs. 54.65), or by 52% of the present handling costs.

57. Departmental working will entail employment of additional labour and supervision thereon. Moreover, it will be necessary to ensure flexibility in the employment of labour to meet the needs of fluctuating receipts of coal wagons. Nevertheless, in sheds, where loss of coal by pilferage is heavy, it would be advantageous to replace contract labour by departmental labour for all operations. Wherever work of handling coal has to be given on contract, preference should, as a rule, be given to genuine co-operatives sponsored by the State Government or other responsible bodies. Such a course would give the Railways the advantages of contract handling and, at the same time, minimise thefts and pilferages, as the State authorities or other sponsoring bodies would ensure clean conduct on the part of co-operatives.

In respect of loading of coal, where it is done mechanically, the requirement of labour is small and steady, and employment of departmental labour for this work will not suffer from the disadvantages mentioned above : on the other hand, it will reduce detentions to locomotives at the coaling stage in sheds and ensure their prompt despatch. This work should therefore be done departmentally.

*Handling and Disposal of Ashes***Handling of Ashes.**

58. The main items of work involved are :—

- (i) cleaning of ashpits;
- (ii) picking of cinders of the size of $\frac{1}{2}$ " and above according to the quantities specified;
- (iii) removal of ashes to nominated dumping areas;
- (iv) sale of picked cinders to railway staff and distribution for railway use; and
- (v) disposal of ashes.

The cleaning of ashpits, where done manually, involves shovelling out of ashes from ashpits. In certain sheds, cinders are picked from the ashes thus collected at ground level, and the ashes are then loaded manually into empty wagons and moved to the dumping sites. In other sheds, ashes are loaded into wagons without picking cinders and cinder picking is done at the dumping site. The lift involved in ashpit cleaning is about $2\frac{1}{2}$ feet and that in manual loading of ashes in wagons about 8 to 10 feet. The lead varies from a few yards to a furlong.

Where ashes are handled mechanically, they are collected in tubs placed inside the ashpits. These tubs are lifted by cranes and unloaded into empty wagons or trolleys which are moved to the dumping ground. The cinder picking operations are carried out at the dumping site.

59. On the Eastern, Northern and North Eastern Railways, the first 4 items of work are entrusted to contractors, and proceeds of sale of cinders to Railway staff are retained by contractors. On the South Eastern and Western Railways, the first 3 items are entrusted to contractors and item (iv), *viz.* 'sale of cinders to railway staff', is arranged departmentally. Item (v) is dealt with departmentally on all Railways. On the Central and Southern Railways, all items of work are done departmentally.

Demerits of Handling Ashes by Contract.

60. On Railways, where contractors are allowed to pick cinders and retain the proceeds of sales to staff, the arrangement has become a source of considerable leakage. It is estimated that the quantity of cinders of $\frac{1}{2}$ " size and above is roughly 1/10th of the total quantity of coal ashes produced which is about 25% of the total coal consumed. In other words, a maximum quantity of nearly 2.5% of the total coal consumed should be reclaimable as cinders suitable as domestic fuel. The stipulated quantities required to be picked up by contractors are generally much lower (1.3% to 1.5%) than this limit. Contractors are, therefore, in a position to reclaim larger quantities of cinders from ashes than those stipulated, which they dispose of in the open market at higher rates. In addition, they show sales under spurious names of Railway employees and sell the cinders saved in this manner, in the market. To increase their income from this source, the contractors also resort to the following malpractices :—

- (a) removal of coal (and locomotive parts) along with ashes; and
- (b) removal of semi-burnt coal which the engine crews are induced to drop and also raw coal broken into small sizes mixed with cinders.

The handling of cinders and ashes has, therefore, become a chronic source of complaints against contractors and of loss to Railways.

Costs of Handling and Sale Proceeds of Cinders and Ashes.

61. Appendix 14 gives the cost of handling ashes and cinders, as also the proceeds from sale of cinders and ashes. The ash handling operations cost the Railways in 1956-57 about Rs. 31.5 lakhs (Rs. 15.3 lakhs for work done departmentally and Rs. 16.2 lakhs for work done on contract)

which is about 0·7% of the fuel bill of Railways. The sale proceeds of cinders amounted to Rs. 9·9 lakhs, sale proceeds of ashes to Rs. 43·6 lakhs, or to a total monetary yield of Rs. 53·5 lakhs. It is significant that the Central, Southern and Western Railways realised Rs. 11·4 lakhs, Rs. 10·4 lakhs and Rs. 20 lakhs respectively by the sale of ashes alone. On the Eastern, North Eastern and South Eastern Railways, it is not generally the practice to dispose of ashes surplus to railway requirements by sales to public. On the Northern Railway, the practice to sell ashes to public is in vogue only on the ex-E.P. section. Under the present-day conditions when building construction is increasing rapidly, ashes can supplement building materials in low cost constructions in the private sector etc. and find a good market. The Railway Testing & Research Centre has been requested to examine the possibility of large scale utilisation of ashes for construction purposes and to organise experimental schemes on each Railway under the Engineering Department.

If the Eastern, North Eastern, South Eastern and the ex-E.I. portion of the Northern Railway also arrange for systematic sale of ashes surplus to railway requirements, there is little doubt that the sale proceeds of ashes could be substantially increased. The extra expenditure of Rs. 32·5 lakhs estimated by the Railways for changing over from contract system to departmental system, wherever the former exists, could be offset by the monetary return of the sale proceeds of ashes.

62. The Committee are firmly of the opinion that the system of picking cinders and handling ashes on contract should be replaced by departmental handling under adequate supervision. Ashpit cleaning and loading of ashes into trucks should be undertaken departmentally under shed control. Cinder picking and disposal of ashes and cinders should be carried out departmentally by the Engineering Department on Railways. At wayside stations, all ash handling operations, including cinder picking, should be carried out departmentally by the Engineering Department. With a proper organisation under the Engineering Department, cinders and ashes could be screened and graded for increased utilisation of ashes by Railways and for more remunerative sales to public.

Recommendations

63. The Committee recommend that:
- A. (i) All coal handling operations should be departmentalised in sheds where losses of coal by pilefrage are heavy.
 - (ii) Loading of coal on engine tenders should be departmentalised in sheds where this is done mechanically.
 - B. Mechanical loading should be introduced in all sheds where coal loading exceeds 70 tons per day.
 - C. Contracts relating to picking of cinders and handling of ashes should be terminated on railways and departmental labour should be organised to handle the various operations as under :
 - (i) Cleaning of ashpits and loading of ashes into trucks for dumping at nominated sites should be undertaken by departmental labour controlled by loco sheds.
 - (ii) Picking of cinders, screening and grading of ashes and disposal of cinders and ashes including utilisation for Railway purposes should be handled by departmental labour controlled by the Engineering department on Railways.
 - D. At wayside stations, including traffic yards, all items of ash handling and cinder picking work should be undertaken by the Engineering department.
 - E. Experimental schemes should be organised by the Railway Testing and Research Centre to examine possibilities of large scale utilisation of ashes for construction purposes.

CHAPTER VII

HANDLING OF SEA-BORNE COAL AT CALCUTTA DOCKS

**Supplies of
Coal to Southern Railway.**

64. Bulk of the supplies of coal to Southern Railway from the Bengal and Bihar coalfields are generally carried by rail to Calcutta Docks and from there by sea to Madras, Cuddalore, Tuticorin and Cochin Ports. The quantities carried by rail-cum-sea route and by all rail route from the Bengal and Bihar coal fields as well as from the Outlying Fields during the last three years and the freight paid thereon, are shown in Appendix 15 (Part I), and summarised in the tables 37 & 38 below.

TABLE 37—*Supplies from Bengal and Bihar Coalfields*

(Figures in thousands)

Year	Rail route	Rail-cum-sea route	Total	Freight on sea-cum-rail route	Freight on rail borne coal	Freight per ton on sea borne coal	Freight rate per ton on rail borne coal	Overall freight per ton
	Tons	Tons	Tons	Rs.	Rs.	Rs.	Rs.	Rs.
1954-55	72	891	963	37,286	1,782	41·85	24·75	40·57
1955-56	342	929	1,271	39,245	7,366	42·24	21·24	36·67
1956-57	375	797	1,172	36,063	8,960	45·25	23·89	38·42

TABLE 38—*Supplies from Outlying Fields (By rail only)*

(Figures in thousands)

Year	Quantity	Freight	Freight Rate per ton
	Tons	Rs.	(in rupees)
1954-55	576	7,013	12·21
1955-56	604	9,069	15·01
1956-57	648	10,032	15·48

It will be observed that the freight on sea-borne coal is nearly twice as high as the freight on rail-borne coal from Bengal and Bihar coalfields and three times the freight on supplies from Outlying Fields.

**Losses in
Transit**

65. Part II of Appendix 15 shows the losses of coal on journey from loading docks to the receiving docks for the various ports as well as the losses on the journey from the receiving docks to the sheds. While the losses in Cuddalore and Tuticorin Ports are higher due to the coal being discharged into lighters in midstream and then brought to the docks for loading into wagons, the percentage of losses up to the receiving docks during the years 1955-56 and 1956-57 was of the order of 2%. In addition there was

about 1·5% loss incurred on the journey from the receiving docks to the sheds. Thus the overall losses exceeded 3% during these two years on the Southern Railway.

The Southern Railway is also incurring an additional expenditure of nearly Rs. 20 millions per annum for carriage of coal by sea. The nearer sources of supply to the South are the Outlying Fields. But at present, coals of the Outlying Fields are ungraded and generally of inferior quality. The Southern Railway has made frequent complaints about the quality of coal received from these sources. If coals of the Outlying Fields could be improved by washing to meet Railway requirements, increased quantities can be supplied by rail route at half the present delivered cost.

**Present
Arrangements
at Calcutta
Docks.**

66. In connection with the arrangements at the Calcutta Docks for despatch of coal to Southern Railway by sea route, it is necessary to make some observations in the light of the examination made by the Committee. Two shipping companies work under a contract with the Coal Controller in connection with the supply of coal to Southern Railway by sea and discharge the following functions :—

- (a) make payment for coal received from individual collieries, including labour welfare cess and stowing duty, etc.
- (b) make payments for rail freight charges from collieries to Docks.
- (c) make payments for handling charges to the Port Commissioners for loading coal into the ships, sea freight and other dues, etc.

The two shippers function as intermediaries for settling the monetary transactions on behalf of the Southern Railway. They submit their claims to the Southern Railway through the Assistant Coal Superintendent and Deputy Coal Controller (Production) working under the Coal Controller for reimbursement of the payments made by them. This arrangement has been in existence for the last 7 years.

**Arrangements
Reviewed in
1949.**

67. It is understood that in 1949, the then Coal Commissioner made a review of the duties performed by the shippers and came to the conclusion that on the basis of the coal handled on account of Indian Railways, the shippers made a profit which, in his opinion, was not commensurate with the responsibility undertaken by them. He suggested to the Government that the work of coal handling at the Docks should be done departmentally as this would result in considerable saving to the Railways. This proposal, however, was opposed by the Calcutta Port Commissioners on the ground that within the rigid hierarchy of Government machinery such a trading scheme could not be successfully worked with speed and efficiency and delays might occur in the payment of port charges, etc. resulting in detention to ships and difficulties in the working at Docks. Another point put forward was that the present system permitted an exchange of wagons amongst the shippers, enabling them to work a pool of railway and industrial coal wagons at the Docks, thereby avoiding detention to ships. The port authorities considered that this interchangeability was essential for the smooth working of the port. The Government finally decided that while a system of coal handling through contractors may continue, the contractors should be selected by call of tenders. This system of tenders is in vogue since 1951 and has resulted in reducing the commission to contractors, which was As. -/12/- per ton prior to 1951, to As. -/3/3 per ton in 1958.

**Payment on
Manifest
Quantity.**

68. The practice at the Docks is that the Marine Surveyors assess the quantity of coal loaded into ships by the displacement of water (draft of the ship) before and after the coal is loaded. This is called 'manifest quantity' on the basis of which all port dues, handling charges and sea freight are payable. The

Shippers Institution at the Calcutta Docks is said to have the advantage of ensuring minimum time losses of ships in Docks as the shippers mutually exchange coal wagons to regulate loading of ships as and when necessary. Under the contractual arrangements, the Southern Railway is called upon to make reimbursement of the payments made by the contractor on the basis of 'manifest quantity' declared by two Marine Surveyors and not on the basis of the wagon invoice weights, although the contractors pay pit-head costs to collieries and freight charges to Railways only for the invoiced weight. We, however, understand that the payment of the value of coal on the basis of 'manifest quantity' is an international practice and applies to coal exported from the Calcutta Port as also to coal transported by sea to industries in the South of the country. While this may be so, we would point out that by adoption of departmental coal handling at Calcutta port the Southern Railway could effect a considerable reduction in the bill which it pays.

Table 39 gives the summary of the despatches of sea-borne coal to Southern Railway during the year 1954 to 1957.

TABLE 39.—*Summary of Sea-borne Coal Despatches from K P. Docks during 1954 to 1957*

Year	No. of Steamers sailed	Manifest Quantity	Invoiced Quantity	Un-connected Quantity	Value of un-connected Quantity	Excess Quantity	Value of Excess Quantity	Total un-connected & excess quantity Col. 5+7	Total value paid for the unconnected & excess quantities Col. 6+8
		Tons	Tons	Tons	Rs.	Tons	Rs.	Tons	Rs.
I	2	3	4	5	6	7	8	9	10
1954 . .	144	9,35,060	8,98,122	28,035	7,47,660	8,903	2,35,930	36,938	9,83,590
1955 . .	111	6,75,037	6,56,550	11,191	2,96,560	7,296	1,94,074	18,487	4,90,634
1956 . .	148	9,00,211	8,63,561	27,681	7,71,574	8,970	2,42,954	36,651	10,14,528
1957 . .	84	4,88,683	4,67,979	15,440	4,74,360	5,264	1,62,812	20,704	6,37,172
TOTAL .		2,998,991	28,86,212	82,347	22,90,154	30,433	8,35,770	1,12,780	31,25,924

NOTE.—The full particulars in respect of 23 steamers for 1955 and 58 steamers for 1957 are not available with Southern Railway. The *pro-rata* excess allowed for these ships would raise the figures in column 8 to Rs. 2,34,288 for 1955 and to Rs. 2,75,230 for 1957 and the total to Rs. 9,88,402.

The figures show that the 'manifest quantity' has been invariably higher than the invoiced weight but the contractors have received payments on the basis of the 'manifest quantity' in respect of pit-head costs, rail freight and other charges involving excess payment by the Southern Railway of nearly $5\frac{1}{4}$ annas per ton. This is in addition to the commission of $3\frac{1}{4}$ annas per ton paid to the shippers. The amounts paid on the basis of the 'manifest quantity' have involved an additional payment of about Rs. 9 lakhs during the period of 4 years.

69. The contractors' bills also include value of coal loaded from 'un-connected wagons' received at the Docks (without card labels), although it is not readily possible to say for what shipments such wagons are meant and what are their invoiced weights. To avoid detention of such wagons or congestion at the Docks, they are diverted to ships ready for loading. The value of these 'unconnected wagons' is adjusted mutually on

receipt of bills from collieries by the shippers. There is, however, the possibility of wagons not booked to shippers drifting into Docks which will naturally not be included in the bills from collieries. There is the possibility of the Eastern and South Eastern Railways admitting claims for such 'unconnected wagons' without their being able to claim reimbursement from the shippers. There is also the possibility of freight charges on such 'unconnected wagons' not being properly claimed by the booking Railways.

Conclusion

70. The Committee after duly considering the objections urged by the Calcutta Port Commissioners as outlined in paragraph 67 above, consider that the Shipping Agency working on behalf of the Railway could be replaced by a departmental organisation capable of meeting the obligations at present discharged by the shippers. If a Railway officer with sufficient commercial experience is posted to control the departmental handling of railway coal wagons at the Docks and is assisted by an experienced Senior Commercial Inspector and a Divisional Accountant, there should be no difficulty in effectively dealing with matters relating to interchange of wagons and prompt payment of dues. As regards monetary transactions, he could, with the help of the Divisional Accountant, satisfactorily arrange:

- (a) payment of colliery bills (vetted by the Accountant) through the Eastern Railway on behalf of the Southern Railway;
- (b) verification of railway freight charges after allowing for the rebate due to the Southern Railway ; and
- (c) prompt payment of port dues and other charges in an authorised manner.

For this purpose, the departmental organisation will maintain full particulars of wagons received and loaded into ships including 'unconnected wagons' and wagons interchanged with other shippers, so that necessary adjustments could be made with other shippers and Port authorities in respect of transactions involved.

During the period of 4 years, the Railways have paid about Rs. 5.7 lakhs as commission to the shippers and an additional payment of about Rs. 9 lakhs on account of the difference between the 'manifest quantity' and the invoiced quantity, or an average of Rs. 3.7 lakhs per annum. A departmental organisation would cost less than Rs. 1 lakh per annum.

Recommendations.

71. The Committee recommend that:

- (A) to save Southern Railway additional expenditure which they now incur in the supply of coal by sea, supplies of coal from Outlying Fields should be increased after steps have been taken to improve the quality of the coals produced in these fields.
- (B) The present contract arrangements for handling of Southern Railway coal at the Calcutta Docks should be terminated as early as possible and replaced by a departmental organisation under a Railway officer with sufficient commercial experience. He should be assisted by an experienced Senior Commercial Inspector and a Divisional Accountant in the management of the work now done by the shippers and in the settlement of monetary transactions relating to:
 - (i) payment of colliery bills;
 - (ii) verification and adjustment of Railway freight charges; and
 - (iii) prompt payment of port dues and other charges in an authorised manner.

CHAPTER VIII

MEASURES FOR REDUCING COAL CONSUMPTION AND EXPENDITURE

72. The factors responsible for increasing coal consumption have been discussed in earlier Chapters. In the course of their investigations, the Committee have found that improvements are necessary in the procedure for procurement and inspection of coal with a view to control the quality of coals received by Railways. There is also room for effecting economies by controlling consumption in sheds and on line, by proper utilisation of locomotive power and by preventing losses through thefts and pilferages. Further, strengthening of fuel organisations on Railways and some improvements in coal accounts and compilation of statistics would also help in the implementation of economy measures. These matters are discussed in the following paragraphs, where existing practices are described and suggestions made for improvement.

Procurement of Railway Coal under Contract

73. At present, the Coal Controller nominates individual collieries for supply of Railway coal. Even though the grades of coal to be supplied by individual collieries are specified, there is no contract between the Railways and the collieries to ensure that the supplies made by them conform to specifications. When supplies of coal are found to be inferior to the grades specified, the Railways make complaints to the Coal Controller, who, at his discretion, imposes penalties. As the loco orders are allocated to a very large number of collieries and there is a large number of complaints, penalties are not always imposed promptly. This does not produce a salutary effect on the defaulting collieries.

Non-railway consumers can draw supplies from collieries of their choice. The area from which coal is drawn is, however, subject to availability of the requisite quality of coals and rationalisation of movement by the Coal Controller. This arrangement gives the consumer a measure of control on collieries and ensures that supplies are of the required quality. If the same system were extended to Railway supplies, it would be possible for Railways to invite offers from collieries in each area and obtain supplies by entering into contracts with those whose offers are accepted. As already stated, such a system will improve control over quality of supplies to Railways. Government should therefore seriously consider giving Railways the freedom to select the collieries from which they are to draw supplies in collaboration with the Coal Controller.

Field Inspection Organisation.

74. The Railways have made complaints to the Coal Controller regarding high percentage of ash and high percentage of slack and dust in coal supplies during the year 1954-55 to 1956-57 as under (See also Appendix 16).

<i>Year</i>	<i>No. of Complaints</i>
1954-55	747
1955-56	1,338
1956-57	1,706

Railways have so far exercised checks on quality of coal at the receiving sheds. In view of the continued supply of inferior coal, the Railways should develop a Field Inspection Organisation to ensure that coal loaded by the

collieries is free from excessive ash, slack, shale and dirt. A pattern of the proposed Inspection Organisation is given at page 60.

**Control on
Wastages—Shed
Consumption.**

75. Consumption of coal on shed services varies from 10 to 15% of the total consumption in steam locomotives. As stated in paragraph 42 of Chapter V, wastages of coal occur in sheds due to excessive shed movements, engines remaining in steam for long hours and indifferent control on issues of coal for miscellaneous purposes. At present, effective control is not exercised on shed working conditions, nor are the figures of coal consumption on shed services maintained separately from the consumption on train services.

Coal consumption in shed movements can be minimised by recording and controlling the following timings :—

- (i) arrival of engine at incoming pit (to be shown on the engine ticket).
- (ii) arrival of engine in shed on repair or service line (to be recorded in a diary maintained by the shunter).
- (iii) time spent in shunting operations to be recorded in the shunter's diary (This would apply to engines picked up for shunting duty).
- (iv) time for steaming preparations and the time engines are held in full steam (to be shown in the shunter's diary).

The above timings could be posted in a register in the form indicated in Appendix 17. With the help of time records, consumption in shed movements, shed shunting, lighting-up and other operations can be worked out on the basis of the scales determined by actual trials on different groups of engines. A ready reckoner (see Appendix 18) which has been evolved on the basis of trials, could be adopted as a guide. This reckoner could be standardised after periodic checks and repeated trials on engines.

The above measures, if properly introduced, would bring to notice abnormal consumption on shed services and help in controlling it.

**Control on
Wastages—
Line Consump-
tion.**

76. Consumption on line forms the bulk (more than 80%) of the total consumption in locomotives. To control this consumption, Railway Administrations have fixed rations for each train service. The rations have, however, not been fixed on the basis of properly conducted trials. The main difficulty in fixing trip rations lies in allowing for variations from scheduled working, *i.e.* taking into account such items as non-scheduled detentions, out of course stoppages and signal checks, train failures (requiring shunting and other operations enroute) and temporary engineering restrictions.

Out-of-course stoppages etc. of a train entail extra consumption of coal. Trials have shown that every 'dead stop' of a passenger or a goods train, carrying average loads, involves an additional consumption of over 350 lb. of coal and the slowing down of a train costs anything from 200 to 340 lb. of coal. In addition, extra time is taken in train operation. A broad gauge passenger train running at a speed of 50 miles an hour decelerates to a halt in about half a minute, but takes about 4·6 minutes to gain the same speed. Similarly, a broad gauge goods train running at a speed of 30 miles an hour is brought to a halt in about 0·55 minutes, but it takes about 3·5 minutes to regain the same speed. Judicious control over out-of-course stoppages, slowing down of trains, avoidance of excessive engine hours in movement of locomotives (between shed to train and back) will help to reduce coal consumption.

The Railways have attempted fixation of allowances for operational variations but they are not based on regular trials. For effective control over consumption of coal in train working, the Committee consider that :

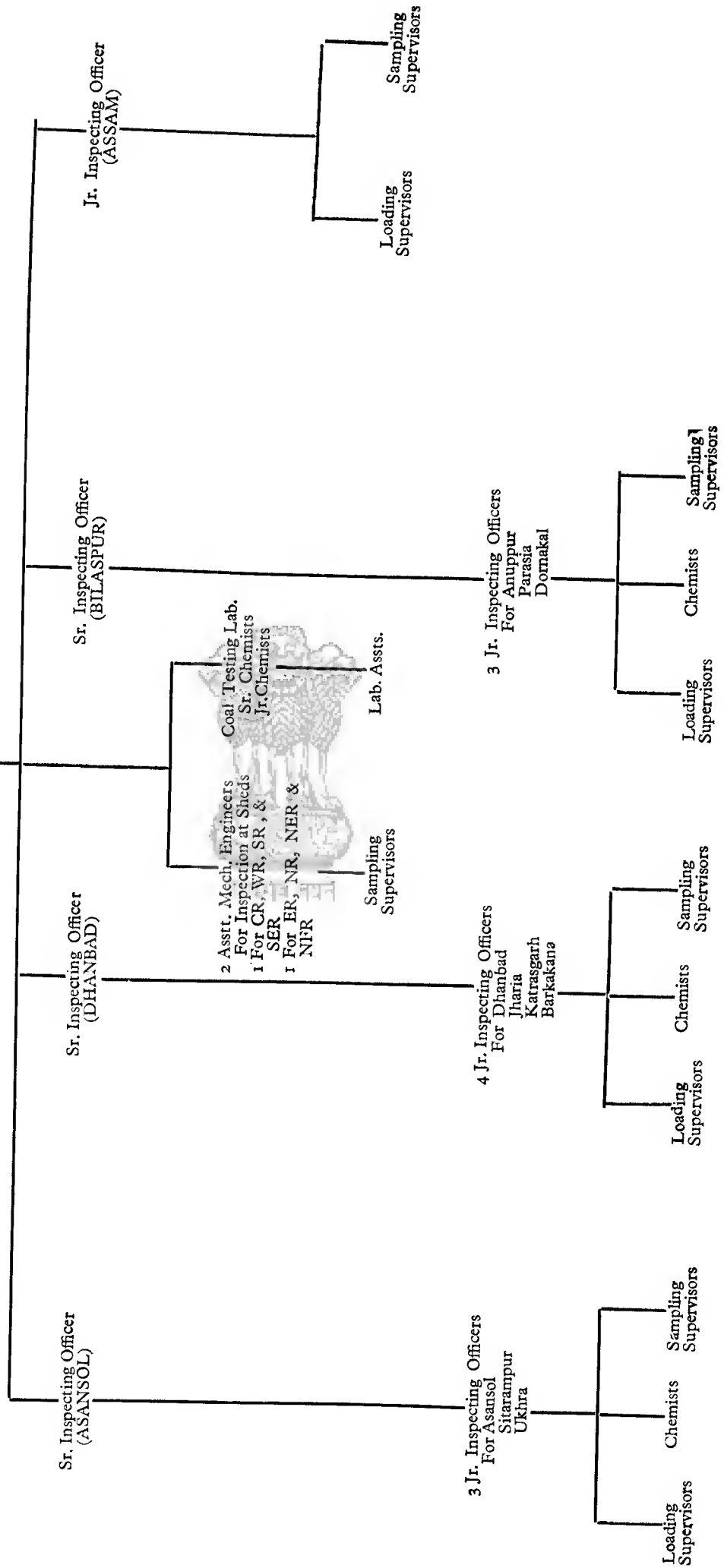
- (a) trip rations for each train service should be fixed on the basis of properly conducted trials, and
- (b) the allowances for factors on which extra coal is consumed should be fixed by trials for the following items :
 - (i) out of course stoppages, lb. of coal consumed in brake application per 100 tons of train load separately for mail/passenger and goods services.
 - (ii) extra detention hours. lb. of coal consumed per hour for locomotives in different grate area groups.
 - (iii) shunting on line. —do—
 - (iv) other extra hours between shed and trains. —do—

In order that information in respect of the above factors is readily available, the following additional information should be furnished on a suitable train document :

Non-Scheduled stops etc.	Consumption allowance as per scale for the extra time.			
	No.	Hrs.	Min.	Cwt.
(i) no. & period of non-scheduled stoppages, including temporary speed restrictions.				
Total period				
(ii) train hours-Scheduled.				
Actual				
Difference				
(iii) shunting on trains.				
(iv) other hours—				
(Shed to duty & back)				
Normally allowed				
Actual				
Difference				
				Total

PROPOSED ORGANISATION FOR INSPECTION OF RAILWAY COAL
(HEADQUARTERS DHANBAD)

CHIEF INSPECTING OFFICER
(Jr. Admin. Rank)



maintenance by intensifying training of shed and running staff. Provision of adequate staff and of training facilities is all the more necessary to cope with the rapid expansion of rail transport in coming years.

Pilferage and Thefts.

78. The Committee have discussed in Chapter V and VI how thefts of coal take place from sheds and running trains. In respect of theft from open wagons on trains detained at signals, etc., the Railway Administrations can do little to prevent this all along the line without the co-operation of State Governments. Such stolen coal is passed on to local coal dealers for sale as domestic fuel or to small industries. The local authorities could question the dealers regarding the sources of supply and examine their accounts—if the sale of steam coal were authorised by the State Governments through licensed dealers only. It is understood that the U.P. Government have taken this step and thereby helped to improve the position in certain areas of the State.

To minimise theft from sheds, it is necessary to introduce the following measures :—

- (i) the security force should be strengthened and, where necessary, armed guards should be posted in sheds and yards ;
- (ii) brick walls should be provided round the sheds where justified. An expenditure of about Rs. 50,000/- in providing a brick wall round a shed will involve a recurring liability of about Rs. 3,000/- per annum towards interest and maintenance charges. Assuming that the delivered cost of coal averages Rs. 30/- per ton, a recurring expenditure of Rs. 3,000/- per annum would be justified for a shed where the loss by pilferage exceeds 100 tons per year or 5 to 6 cwts. per day ;
- (iii) strong disciplinary action should, as a rule, be taken against drivers where reasonable evidence is forthcoming regarding their indulgence in the stopping of trains to drop coal.

Strengthening of Fuel Organisations on Railways.

79. The measures suggested in the foregoing paragraphs call for special attention being given by Railways to the following :—

- (i) accuracy of assessment of coal issues and tender balances in sheds ;
- (ii) adequate supervision on shed working ;
- (iii) adequate supervision on line working ;
- (iv) adequate training facilities ;
- (v) coal trials for checking trip rations ;
- (vi) increased laboratory facilities ; and
- (vii) effective control at Divisional and at Headquarter level.

The above matters will receive the required attention if the Fuel Organisations are suitably strengthened on the following lines :

To ensure accuracy in the checking of tender balances and issues of coal, the staff employed should possess the requisite standard of education and sense of responsibility and should be given a suitable grade to attract the right type of men.

In order that shed working may be adequately supervised and records of coal issues and consumption etc. properly maintained, it is necessary to provide whole-time Supervisors in sheds, whose main responsibility will be to control consumption in shed services by regularly checking consumption at different stages and to examine fuel accounts and returns. These Supervisors can also be advantageously employed for controlling departmental labour employed in sheds for handling of coal and ashes.

Control on line working is at present exercised by (i) Loco Inspectors who look after the maintenance and operation of locomotives and enquiries relating to failures and accidents, and (ii) by Fuel Inspectors who fix the trip rations, train footplate staff, and exercise control on coal consumption. In this connection, it has come to the notice of the Committee that Inspectors deputed for fuel control are often detailed to duties normally assigned to Loco Inspectors. To avoid such contingencies, it may be necessary to review the strength of Loco and Fuel Inspectors and to provide adequate Supervisors in each category.

The efficiency of Fuel Organisations largely depends upon the knowledge and experience of Supervisors and Officers responsible for exercising control over coal consumption. It is, therefore, necessary to improve the training of both Supervisors as well as Officers in fuel matters. The Committee note that the need for such training has already been accepted by the Railway Board, and a Central Fuel Training School has been set up at Jamalpur as a temporary measure. A permanent school will be set up at Dhanbad in due course. The provision of adequate facilities at Dhanbad, to meet the expanding requirements of Railways, should now receive special attention. It is also desirable to introduce a course on 'Fuel Economics' in the Railway Staff Training College at Baroda.

In addition to staff and training facilities, the Fuel Organisations on Railways should be provided with Fuel Test Car Units for carrying out coal trials regularly, in order to exercise checks on trip rations. Further, in order to make frequent checks on the quality of coals received by the Railways, the Committee consider that additional laboratory facilities should be provided, small laboratory units being located in each Division for analysing coal and boiler water.

The tightening of fuel control on the lines indicated above would necessarily impose an additional burden on the Mechanical Officers in Divisions who are already carrying an increasing load of work arising from the rapidly growing traffic. It would, therefore, be necessary to provide one additional Assistant Mechanical Engineer in each Division, so that fuel control work receives the attention it deserves.

**Coal Accounts-
Linking of
'Missing' and
'Unconnected'
Wagons.**

80. Coal wagons consigned to a particular Railway do not reach their booked destination when they are intercepted by the home or other Railway. In such cases, the sheds or distributing centres to which wagons were originally consigned submit reports of 'missing' wagons (not received by them) to the Railway Central Accounts Office. Wagons become missing because of diversion of coal wagons from one shed to another by the Railway itself or other causes. Sheds or distributing centres also submit particulars of receipts of wagons not originally consigned to them. Such wagons are treated as 'unconnected' wagons. They become unconnected when the despatch particulars are lost in transit and the wagon labels get defaced or lost. The Central Accounts Office on the Railway checks the particulars of the 'missing' wagons with the help of wagon disposal statements submitted by the colliery-base stations, and with the list of 'unconnected' wagons. This helps to connect some wagons consigned to home Railway stations but for the rest detailed enquires from other Railways are necessary, as the missing wagons of one Railway may be unconnected wagons of another. A centralised system of linking of 'missing' and 'unconnected' wagons is therefore desirable.

In Appendix 19(a) are shown, for the years 1954-55 to 1956-57, the number of wagons consigned to each Railway from colliery base stations, the number of wagons received by the sheds (connected as well as unconnected), the num-

ber of 'missing' wagons and the number subsequently traced and connected. The position is summarised in Table 40 below :—

TABLE 40—*Missing and Unconnected Wagons on Railways*

Year	No. of wagons consigned from colliery-base stations	No. of wagons received against col. (2)	Unconnected wagons received	No. of missing wagons	Wagons in col. (4) traced up to 31-3-57	Wagons in col. (5) traced up to 31-3-57
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1954-55	4,92,955	4,81,446	10,684	11,509	7,282	6,514
			2.2	Percentage of wagons consigned 2.3	1.5	1.3
1955-56	5,07,604	4,93,691	12,594	13,913	5,574	9,365
			2.5	Percentage of wagons consigned 2.7	1.1	1.8
1956-57	5,65,649	5,48,582	15,279	17,067	4,328	4,472
			2.7	Percentage of wagons consigned 3.2	0.8	0.8

It will be seen that 2.3% of the wagons consigned to Railways are found to be 'missing' and the same percentage of wagons remain 'unconnected' on the Railways taken together. Even after a lapse of time, 0.5% to 1% of the 'missing' and 'unconnected' wagons remain unlinked. The checks conducted by the Committee's Inspectors at certain stations on Railways did not disclose any malpractices in the accounting of 'unconnected' coal wagons. However, as an insurance against possible losses of complete wagon loads, there is need for expeditious linking between 'missing' and 'unconnected' wagons under centralised control on the lines indicated in Appendix 19 (b).

Coal Consumption Statistics.

81. The figures relating to performance *viz.*, train miles, gross ton miles, train engine hours, other engine hours, consumption in lb. per 1000 gross ton miles are compiled on Railways by their Central Statistical Offices. On the Central Railway, the data is first compiled in the Divisions and passed on to the Central Statistical Office in the form of punched cards. This ensures availability of the performance figures for each shed on the Division and early preparation of the overall Railway and divisionwise statistics in the Central Statistical Office. It also prevents inaccuracies in compilation arising from returns from all sheds not being timely and fully received in the Central Office. The Committee, therefore, consider that decentralisation of the compilation of fuel and operating statistics to the Divisions would improve control over coal consumption by the authorities on the spot and ensure effective implementation of fuel economy measures.

The other important point, which deserves special attention to avoid errors in the compilation of statistics, relates to the need for general reconciliation between the figures of coal consumption and issues of coal made

by sheds to locomotives. The figures of coal consumption should be arrived at as follows :—

Consumption of coal on Home Division locomotives	-
Issues to all locomotives from Home Division sheds	<i>Minus</i>
Issues to locomotives of other Divisions of Home Railway and of other Railways	<i>Plus</i>
Issues to Home Division locomotives by other Divisions and other Railway sheds	

These figures of consumption and issues should be furnished by Divisions to the Central Statistical Office for preparation of final results.

The statistical data is at present compiled for 'passenger and proportion of mixed services' and 'goods and proportion of mixed services'. The passenger services include local and suburban services for which the rates of consumption are considerably higher than those for mail and express trains. Similarly, goods services include 'pick-up and van goods', which being slow trains involve widely varying detentions and stoppages enroute and entail much higher consumption rates. The results of performance indicated by the two main service groups *i.e.*, 'passenger and proportion of mixed' and 'goods and proportion of mixed' do not permit a proper appreciation of the performance of individual services. For efficient control, the Railways should compile and publish data in their Domestic Statistics, separately for the following services :—

- (i) *Passenger Services :*
 - (a) mail and express.
 - (b) passenger and parcel.
 - (c) local and suburban.
 - (d) all passenger.
 - (e) proportion of mixed.
 - (f) passenger and proportion of mixed.
- (ii) *Goods Services :*
 - (a) through goods.
 - (b) pick-up and van goods.
 - (c) all goods.
 - (d) proportion of mixed.
 - (e) goods and proportion of mixed.

Conclusions.

82. Control measures discussed in this chapter are summarised as follows:—

- (i) Introduction of direct contracts between Railways and collieries.
- (ii) Setting up of a Railway Inspection Organisation in the Coalfields.
- (iii) Prevention of wastages and losses by:
 - (a) control on coal consumption in sheds;
 - (b) control on line consumption and economic utilisation of power;
 - (c) training of maintenance and running staff;
 - (d) preventing pilferage and thefts.
- (iv) Strengthening of the Fuel Control Organisations on Railways.
- (v) Coal Accounts-linking of 'missing' and 'unconnected' wagons.
- (vi) Improvement in coal consumption statistics.

Recommendations.

83. The Committee recommend that:
- A. To control the quality of coal supplies, Railways should have the same freedom to select collieries (in collaboration with the Coal Controller) as non-Railway consumers have.
 - B. The setting up of the Railway Inspection Organisation in accordance with the pattern indicated by the committee should be expedited.
 - C. Coal consumption on shed movement should be controlled by recording the time spent on shed services.
 - D. Trip rations for train services and a scale of allowances for extra consumption due to out-of-course stoppages and detentions should be fixed on the basis of properly conducted trials.
 - E. Facilities for training of shed and running staff should be increased to improve the standards of locomotive maintenance and firing technique. Further, a review of the Maintenance organisation on Railways is necessary to meet the requirements of rapidly increasing traffic and Rolling Stock holdings.
 - F. Investigations regarding the specifications of lubricating cylinder oils should be finalised as early as possible.
 - G. Co-operation of the State Governments should be sought to regulate the sale of steam coal only through licensed dealers so that local authorities can question the sources of supply by examining their accounts and other means, in the event of any malpractices being suspected.
 - H. The strength of Security Force, which the Railways consider inadequate for keeping a watch over coal stacks in sheds and over loaded coal wagons standing in yards, should be suitably augmented without delay; armed guards should be posted in sheds and yards as a drive against pilferage where necessary.
 - I. Although the expenditure on the provision of brick walls to prevent the entry of outsiders into Loco sheds is heavy, it is amply justified at sheds where pilferage is found to be heavy.
 - J. Severe disciplinary action should be enforced against drivers and other staff wherever reasonable evidence is forthcoming regarding their indulgence in the stopping of trains at vulnerable points and other malpractices leading to leakage of coal.
 - K. Fuel organisations on Railways should be suitably strengthened to implement the control measures on the lines indicated in paragraph 79.
 - L. A centralised system of linking 'missing' and 'unconnected' wagons should be introduced as a safe guard against possible loss of complete wagon loads.
 - M. Initial compilation of coal and operating statistics should be decentralised to divisions to permit better control by local authorities.
 - N. Before compilation of coal consumption statistics there should be a general reconciliation between the figures of coal consumption and issues of coal by sheds to locomotives.
 - O. The railways should compile and publish statistical data relating to coal consumption separately for the following services:—
 - (i) Passenger services:
 - (a) mail and express.
 - (b) passenger and parcel.
 - (c) local and suburban.
 - (d) all passenger.
 - (e) proportion of mixed.
 - (f) passenger and proportion of mixed.
 - (ii) Goods services:
 - (a) through goods.
 - (b) pick-up and van goods.
 - (c) all goods.
 - (d) proportion of mixed.
 - (e) goods and proportion of mixed.

CHAPTER IX

COAL RESERVES, PRODUCTION AND REQUIREMENTS OF VARIOUS GRADES OF COAL FOR RAILWAYS UNDER THE SECOND AND THIRD FIVE YEAR PLANS AND ANTICIPATED DEFICIENCIES

Coal Reserves. 84. The Coal seams of the country occur in strata of two distinct geological formations :—

- (i) Measures of Gondwana age; and
- (ii) Measures of Tertiary age.

The Gondwana coals lie in Bengal, Bihar, Madhya Pradesh, Orissa, Madras and Hyderabad States. The Tertiary coals lie in Assam, Punjab, Kashmir and Rajasthan States.

The Geological Survey of India have recently surveyed the reserves of both Gondwana and Tertiary coals and have given the following estimate :—

(Million Tons)	
(i) estimated (proved) reserves.	42,649
(ii) inferred reserves to a maximum depth of 3000 to 4000 ft.	79,392
	1,22,041

They have divided the estimated reserves of 42,649 million tons into two categories :—

Category A—Low volatile coals with less than 15% ash. and high volatile coals with less than 13% ash ;

Category B—Coals inferior to the above.

A break-up of the reserves of coking and non-coking coals under categories A & B is given as under :—

Category A

(Figures in million tons)

	Coking	Non-coking	Coking	Non-coking	
	Upto 1000 ft. depth	From 1000 to 2000 ft. depth	Total		
Gondwana coals	2,294	3,446	935	2,079	
Tertiary coals . . . . .	..	1,250	..	800	
	2,294	4,696	935	2,879	10,804

Category B

(Figures in million tons)

	Coking	Non-coking	Coking	Non-coking	
	Upto 1000 ft. depth	From 1000 to 2000 ft. depth	Total		
Gondwana coals	7,932	13,970	3,985	3,475	
Tertiary coals . . . . .	..	2,483	..	..
	7,932	16,453	3,985	3,475	31,845

According to these estimates, the known reserves of coking coals in Category A are 3,229 million tons and those of non-coking coals 7,575 million tons.

Coal Production up to 1957.

85. The production of coal in India at the end of the 19th century was 6.12 million tons per annum. The output rose to 16.5 million tons in 1914 and to 21 million tons in 1918, *i.e.* at the end of the First World War, the Jharia and Raniganj Coalfields contributing 11 million and 6½ million tons respectively. The Indian Coalfields Committee 1946 gave the figures of coal production during the year 1920 to 1945 as in table 41.

TABLE 41—Coal Production in different Years

Year	Production (Million tons)
1920	17.96
1921	19.30
1922	19.01
1923	19.65
1924	21.17
1925	20.90
1926	20.30
1927	22.08
1928	22.54
1929	23.42
1930	23.80
1931	21.72
1932	20.15
1933	19.79
1934	22.06
1935	22.02
1936	22.61
1937	25.04
1938	28.34
1939	27.77
1940	29.39
1941	29.46
1942	29.43
1943	25.37
1944	25.96
1945	28.97
* 1951	34.31
* 1955	38.21
* 1956	39.43
* 1957	43.50

*Added by the Expert Committee.

It will be observed that during recent years there has been a rapid increase in the production (and demands) of coal in the country.

The gradewise production of coal during 1957 from the Bengal, Bihar and Outlying Fields was as follows:—

		(in million tons)
Coalfield	Grade	Output
Bengal/Bihar	Selected A	7.603
	Selected B	10.973
	Grade I	8.488
	Grade II	5.486
	Grade IIIA	0.722
	Grade IIIB	1.470
TOTAL		34.742

Outlying

Assam	.	.	.	.	.	.	.	} Not yet graded	0.575
Andhra	.	.	.	.	.	.	.		1.929
Bombay	.	.	.	.	.	.	.		0.611
Madhya Pradesh	.	.	.	.	.	.	.		5.048
Orissa	.	.	.	.	.	.	.		0.533
Darjeeling & Bikaner	.	.	.	.	.	.	.		0.066
TOTAL									8.762
GRAND TOTAL									43.504*

*Includes 15.080 millions tons of coking coal.

Trend of Rail-
way Require-
ments.

86. The quantities of various grades of coal received by Railways during the three years 1954-55, 1955-56 and 1956-57 are given in table 42 below:

TABLE 42.—*Coal Supplies to Railways (1954-55—1956-57)*

(Figures in million tons)

Grade of coal	Quantity of coal received in			
	1954-55	1955-56	1956-57	Jan. 57 to Dec. 57
Selected A	0.849	0.977	0.935	1.44
Selected B	2.986	3.636	3.671	3.66
Grade I	2.426	3.547	3.636	4.12
Grade II	0.817	0.943	1.137	0.67
Ungarded	2.966	2.864	3.556	3.47
TOTAL STEAM COAL	10.044	11.967	12.935	13.36*
TOTAL OTHER COAL	0.570	0.555	0.696	0.75
GRAND TOTAL	10.614	12.522	13.631	14.11

*Includes about 5 millions tons of coking coal.

Anticipated
Demands in
1960-61 and
1965-66.

87. The anticipated annual demands of coal by 1960-61 (end of Second Plan) and by 1965-66 (end of Third Plan) are about 60 million tons per annum and 100 million tons per annum respectively. Details are shown in table 43. The requirements of Railways are estimated at 16.5 million tons in 1960-61 and 26 million tons in 1965-66 :

TABLE 43—*Anticipated Annual Demands—1960-61 and 1965-66.*

(Figures in million tons)

Sectors	Demand	
	by 1960-61	by 1965-66
Railways (steam & electric but excluding diesel)	16.5	26.0
Iron & Steel	11.0	27.0
Power	5.0	16.0
Brick burning, Cement & Potteries	9.0	12.0
Other industries	12.0	15.0
Domestic & Provincial	3.5	8.0
Synthetical oil and domestic coke	..	5.0
Bunker and export	2.9	3.0
Total	59.9	112.0
Less Middlings	..	12.0
	59.9 (Say 60.0)	100.0

**Increased
Production in
Second Plan.**

88. The details of the additional quantity of 21·21 million tons of coking and non-coking coals of various grades proposed to be raised by 1960-61 over 1955 production are given in Appendix 20.

The gradewise breakdown of anticipated production of coking and non-coking coals in 1960-61 is as under :—

	Run of Mine	(Figures in million tons) Steam or large coal taken as 66% of R.O.M.
(a) <i>Non-coking coals.</i>		
Selected A	6·83	1·51
Selected B	12·91	8·52
Grade I	5·67	4·73
Grade II	2·94	1·94
Ungraded coal from Outlying Fields .	12·05	7·80
	40·40	27·50
(b) <i>Coking Coals</i>		
	19·05	
TOTAL PRODUCTION .	59·45	

A preliminary target for the output by 1965-66 (in which coking and non-coking coals are not separated) is given below :—

	Million Tons
Selected A & B.	31·05
Grade I	30·10
Grade II	25·35
Grade III.	10·20
	96·70
Lignite (No grade)	3·50
TOTAL .	100·20

**Estimate of
Railway
Requirements
in 1960-61 and
1965-66.**

89. The requirements of Railway coal are influenced by the grades of coal supplied. The best results, both in respect of coal consumption and costs, can be achieved by use of Selected Grade coking coals. But as adequate supplies of such coals are not available, the Railways have in the past used lower grades of coking and non-coking coals. This was possible as the locomotives were able to haul the loads specified at the time with lower grades, although their use involved extra consumption of 10% to 25%. On practical considerations, the Central Standards Office for Railways laid down in 1952 the following 'scheduled' and 'minimum' grades of coal for locomotives of different designs to haul the prevailing loads.

TABLE 44.—*Central Standards Office Schedule of Coals for Use in Locomotives.*

Type of locomotive	Scheduled Grade	Lower grade which will provide the required power for scheduled services	Increase in consumption if lower grades of coal are used
BESA	Sel. Grade Coking	Grade I Coking	10% to 15%
Old IRS	Grade I Coking	Grade II Coking	20% to 25%
New IRS	Grade I Non-coking	Grade II Non-coking	15%.
Shunting	Grade I, preferably Coking	..	Any lower grade involves considerable wastage.

While at the time the use of the lower grades of coal was possible, the position has considerably altered since. Locomotives have now to move far heavier loads and these will progressively increase in coming years. On this account, the Committee feel that the lower grades of coal specified by the Central Standards Office in 1952 no longer hold good.

In order to ensure efficient operation of heavy train loads, it is necessary to use coals of calorific value not much lower than 12,000 Btu/lb. which is the calorific value of coking coals of Grade I or of non-coking coals of Selected Grade. The BESA locomotives were designed to burn Selected Grade coking coals, and the earlier IRS locomotives to burn coking coals of Selected Grade and Grade I in quality. A large number of both these types of locomotives will continue to be in service during the next decade. Further, replacement of about 5 million tons of coking coals by non-coking coals will necessitate greater use of high grade non-coking coals as, in calorific value, non-coking coals correspond to coking coals of one grade lower in quality. Based on these considerations, the following estimates of the Railway requirements at the end of 1960-61 and 1965-66 have been made. The estimate for 1965-66 is on the assumption that goods loading will increase to about 245 million tons per annum.

(Figures in million tons)

Non-coking coals	1960-61	1965-66
Selected A & B	9.0	14.0
Grade I	7.5	12.0
TOTAL	16.5	26.0

Grade II non-coking coals have not been included in the demand although Railways at present use a proportion (about 15%) of Grade II non-coking coals for shunting, departmental and non-loco purposes. It will not be possible indefinitely to continue to accept this quality of coal for the heavier duties to be performed by locomotives and intensive yard working consequent upon increased traffic. Until, however, washeries are in operation and improved qualities of coals become available Railways will have to continue to use these coals despite the repercussions on performance.

While the anticipated production of specified grades of non-coking steam coals by 1960-61 (indicated in paragraph 88) would appear to be adequate to meet the Railway requirements of 9.0 million tons of Selected Grade coals, it is doubtful whether the Grade I coal produced by Bengal & Bihar and the Outlying Fields can meet fully the Railway requirements of 7.5 million tons, let alone other consumers.

**Replacement
of Railway
Supplies of
Coking Coals
by Non-Coking
Coals.**

90. As regards replacement of 5 million tons of coking coals by non-coking coals one grade higher in quality by 1960-61, the position on the basis of the specified grades would appear to be as in table 45 :

TABLE 45—*Replacement of Coking by Non-Coking Coals.*

(Figures in million tons)

Grade	Coking coal to be replaced on the basis of 1957-58 supplies	Additional non-coking coal production available for replacement from Ranigani and Karanpura Coalfields by 1960.
Selected A	0.49	0.49
Selected B	1.74	4.56
Grade I	2.73	1.87
Grade II	0.13	0.14
	5.09	7.06

From table 45, it would appear that it might be possible to replace the Selected A & B coking coals by Selected A & B non-coking coals, grade for grade and not by one grade higher in quality ; and so far as Grade I coking coal is concerned, it would appear possible to replace it by Selected B non-coking coal. But the figures of additional production of non-coking coals relate to specified grades whereas actual supplies are likely to be inferior. This is shown by the two rapid quality surveys undertaken by the Railways in September 1957 and January 1958. (See table 46.)

TABLE 46—Percentage of Supplies Conforming to Specified Grade

Specified Grade	Rapid Quality Survey September, 1957.				Rapid Quality Survey January 1958				Assumed %ages adopted for arriving at the actual availability of steam coals as against nominal grades produced			
	Correct to speci- fied grade	One grade lower	Two grades lower	More than two grades lower (unven- dible)	Correct to speci- fied grade	One grade lower	Two grades lower	More than two grades lower (unven- dible)	Correct to speci- fied grade	One grade lower	Two grades lower	More than two grades lower (unven- dible)
	%	%	%	%	%	%	%	%	%	%	%	%
<i>Bengal & Bihar Field:</i>												
Sel. A	38	26	15	21	48	12	26	14	50	20	20	10
Sel. B	32	32	24	12	37	29	23	11	35	30	25	10
Gr. I	45	32	22	1	49	23	26	2	50	25	25	..
Gr. II	60	37	3 (un- vendible)	..	68	32	..	..	65	35	..	..
<i>Outlying Fields</i>												
Ungraded (assuming Gr. I as the Standard)	35	16	42	7	36	25	37	2	35	20	40	5

Prospects of Future Sup- plies.

91. Taking into consideration the deviation of the actual supplies from specified grades as shown in table 46, it is apprehended that the supplies to Railways in 1960-61 will probably fall into the grades indicated in table 47 below :

TABLE 47—Railway Requirements and Probable Supplies

(Figures in million tons)

Grade	Railway supplies required (specified grades)	Probable supplies (actual grades)
Selected A & B	9.0	6.0
Grade I	7.5	4.3
Grade II	..	3.7
Lower Grades	..	2.5

Thus, the assessment of requirements of Railways compared with the actual availability of the different grades of coal suggests that there will be a real deficiency of the specified grades. The result of such deficiency would be that the annual consumption of coal by Railways would increase by nearly 2 million tons of coal, involving an annual additional expendi-

ture of about Rs. 6 crores at present prices—to say nothing of the possible failures in the planned transport. One method of meeting this shortage in high grade coals (Selected A to Grade I) is to wash inferior coals of which there is ample supply.

A fall in quality would moreover necessitate higher rates of firing which would be beyond handfiring capacity on locomotives operating heavy goods services. This disadvantage can be overcome to a degree by using mechanical stokers, but the consumption of coal would rise still further. The position is likely to become worse during the Third Five Year Plan.

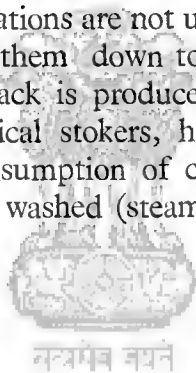
The above analysis reinforces the recommendations made by the Committee in Para 27 of Chapter III regarding the urgent necessity for control of quality at loading points.

Recommendations.

92. The committee recommend that—

- (i) **In order to guarantee reliability and uniformity in quality of future supplies, the time is ripe for the establishment of washeries in certain fields to upgrade non-coking coal.**
- (ii) **In order to counteract any fall in the hauling capacity of locomotives during the present difficult period, mechanical stokers should be fitted to heavy goods locomotives as far as practicable even though coal consumption may go up.**

These two recommendations are not unrelated. When coals are washed, it is necessary first to break them down to a certain size, and in this process an additional quantity of slack is produced which cannot be used on hand fired locomotives. Mechanical stokers, however, can utilise this slack but with some increase in consumption of coal. At the same time, however, there will be the benefit of washed (steam) coal for hand firing.



CHAPTER X

MEASURES NECESSARY TO MEET DEFICIENCIES IN FUTURE SUPPLIES

Need for Washing In- ferior Coals.

93. It has been indicated in Chapter III that there has been a progressive decline in the quality of coal supplied to Railways. Some of the reasons for deterioration have also been given. In respect of the quality of coals mined, the Coal Washeries Committee (1954) observed as follows :—

“In our opinion, the deterioration in quality is due to both human and natural factors. As regards natural factors, deterioration in quality of raisings is unavoidable due to inherent heterogeneity of our coal seams and due to the fact that majority of the collieries are now in a depillaring stage where inferior sections are being worked along with selected sections in which mining commenced in the development stage..... It is, however, well known that mechanical mining seriously affects the quality of coal raisings due to the inclusion of dirt bands etc. which can be avoided in manual mining and also by reducing the size of coal and dirt pieces which render hand-picking impossible.”

The Committee generally agree with the above observations.

In the preceding Chapter, it has been shown that there is likely to be a shortage of the high grade coals which are required by Railways. However, the reserves of low grade coals are plentiful and from them it is possible to obtain by washing, supplies of the requisite quality for locomotive use. Industrially developed countries have adopted this approach extensively during the last three or four decades. Due to reduced consumption when washed coal is used, there is less transport of coal and thus less freight charges. Moreover, wagons are released for more remunerative traffic.

Washery Pro- posals for Rail- ways.

94. The Central Fuel Research Institute has made studies of the washability characteristics of non-coking coals and has suggested the following five washery schemes for Railway coal.

Location of Washery	Coalfield served	Estimated working capacity	Proposed design capacity
		Tons per hour	Tons per hour
(i) Ondal	Raniganj	530	600
(ii) Barkakana	Karanpura	420	500
(iii) Anuppur	C.I.C.	360	400
(iv) Junardeo	Pench Valley	240	300
(v) Kothagudium	Singareni	320	400

The main processes included in the Washery Schemes are briefly as follows :—

- (1) Screening of Run-of-Mine coal to +1" size, which gives :—
 - (i) +1" coal (known as steam coal, yield about 70%), and
 - (ii) —1" (known as slack, yield about 30%).
- (2) The + 1" coal is screened up to 4" size and the quantity + 4" is crushed below 4" and screened at 1". This gives:—
 - (i) Steam coal 4" to 1" size (yield about 50%), and
 - (ii) —1" slack, yield about 20%.

We thus obtain 50% of steam coal and 50% of slack.

(3) The 4" to 1" size steam coal is then washed yielding :—

- (i) Cleans
 - (ii) Middlings
 - (iii) Rejects
- } or crude middlings only.

(4) The middlings can be processed in two ways :—

- (a) by conversion into soft coke with or without additional raw coal as may be necessary, or
- (b) by blending the middlings with the slack to produce a suitable fuel for thermal stations.

The economics of the washery schemes have been computed from the flow sheets (at pages 77—81 and Appendix 21) for the alternative modes of utilisation of middlings.

Financial Assessment.

95. The net financial gain or loss to the Railways by adopting the alternative courses (a) and (b) has been worked out for the five washeries, taking into consideration the financial gain in terms of reduced freight on coal and release of wagons from unremunerative coal traffic. The results are shown in tables 48 and 49 at pages 82 and 83 respectively.

In making the financial assessment, the cost of the washing process has been taken at the rate of Rs. 1.18 per ton of raw coal washed. This cost, as will be seen from table 50 at page 84 covers interest, depreciation and maintenance of the plant as well as costs of marketing and general administration on a scale of 33 $\frac{1}{3}$ % of the operating costs.

The figures for different products shown in the flow sheets (pages 77—81) have also been made more conservative than those adopted by the Director, Fuel Research Institute and allowances have been made for rejects.

Adopting the above basis, it will be observed from table 48 that, the alternative (a) in the case of Ondal and Barkakana Washeries might involve a loss of about Rs. 14.7 lakhs and Rs. 19 lakhs per annum respectively. The other 3 Washeries viz. Anuppur, Junardeo and Kothagudium should give a net gain of Rs. 12.0 lakhs, Rs. 11.7 lakhs and Rs. 1.5 lakhs respectively or a total of Rs. 25.2 lakhs per annum for a yield of nearly 3 $\frac{1}{2}$ million tons of clean coal of consistent grade I quality. Under alternative (b) (table 49) for utilisation of middlings, the financial results become poorer.

The setting up of the three Washeries showing a net gain would only touch the fringe of the problem, as they would yield only 3 million tons of Grade I coal by washing from 6.0 million tons of Grade II raw coal. Even with immediate implementation of these proposals, the washeries will commence production only at the end of the Second Plan. The Washeries schemes would, therefore, afford some relief during the Third Plan period. The problem has to be considered from a long range point of view, as washing of large quantities of coal for railway use may be necessary later.

Long Range View.

96. Coal will continue to be the main source of power in India for many decades inspite of the increased utilisation of energy from other sources—including atomic energy. A group of Experts in their report for "Europe's Energy Requirements" has recently observed as under :—

"For many years to come conventional forms of energy will be needed and coal must remain the mainstay of the Western European energy economy. We are all agreed that today its future is being seriously prejudiced by misconceptions in the public mind as to the part they expect the nuclear energy to play in the near future. Exaggerated statements about nuclear energy have led the public to regard coal as out of date and of little concern to them. One must therefore

draw attention to the adverse effects which this over-optimism over the role of nuclear energy in the near future is having on recruitment, investment, and scientific development in the coal industry It is essential in our opinion that responsible authorities and the public should be made to realise the need for a new outlook on coal."

The Requirements and Utilisation Committee constituted by the Coal Council of India have assessed the energy requirements of the country up to 1975 by alternative methods :—

- (a) on the basis of a 10% compound increase annually over the commercial non-domestic energy produced in 1955, and
- (b) making an assessment of the requirements for various consuming blocks, such as iron and steel, thermal power, domestic sector, Railways and other miscellaneous industries.

They have assessed the total coal requirements by 1975 to be of the order of 380 million tons of coal equivalent, of which 300 million tons are coal itself.

On the basis of the apparent ratio of 3 million tons of freight carried by rail for every one million tons of coal consumed in the country, their estimate of the load on rail transport by 1975 is of the order of 1,000 million tons. Alternatively, they have assumed a transport load of 4 tons *per capita* per annum by 1975 as against a $\frac{1}{3}$ of ton *per capita* at present. On this basis, the total transport load has been estimated to be of the order of 2,000 million tons, 40% of which may have to be carried by rail and the rest by road and waterways. This gives the transport load on rail to be of the order of 800 million tons by 1975. Statistics show that for every 10 tons of goods carried by Railways the consumption of coal by Railways is 1 ton, *i.e.* about 10%.

The Requirements and Utilisation Committee have further observed that if rail transport is developed solely under steam traction, the Railway requirements of coal will be about 80 million tons per annum by 1975. Considerations of resources and production possibilities show that it will be extremely difficult to meet these requirements fully or even substantially, as this will entail the mining and processing of 150 to 200 million tons of run-of-mine coal depending on the quality. It has been suggested by the Requirements and Utilisation Committee that the solution of the problem lies in the rapid electrification of Railways so that by 1975 nearly 50% of rail transport is operated by electric traction, 25% by diesel traction and the balance 25% by steam traction. Assuming the above development, 30 million tons of coal will still be required for rail transport of which about 10 million tons of inferior coal will be for power generation for electric traction.

Whether the transport load on the Railways will reach the figure of 800 million tons by 1975 is uncertain. The present trend of traffic indicates that the increase in each five-year Plan will be about 50% of the goods traffic at the beginning of the Plan. On this basis, the Committee estimate that the goods traffic will rise to about 570 million tons by 1975. Assuming that all additional traffic will be moved by steam locomotives, the requirements of coal will be about 50 million tons by 1975. This estimate allows for 15% increase in passenger traffic from Plan to Plan. Even on this reduced estimate, the requirements of coal for Railways will be high and the problem of finding adequate supplies of suitable coal will remain.

As steam traction will continue to play an important part in Railway transport for many years, the preparation of coal for use by Railways is essential both as a short term and as a long term measure. By progressively increasing the number of Washeries for Railway use, shortages of good coal could be met and the public exchequer would thereby avoid substantial losses. Washing would also prevent loss of Railway operational efficiency. The tempo of traffic is rising rapidly and it is therefore essential to ensure that a critical situation is not allowed to develop.

Recommendations

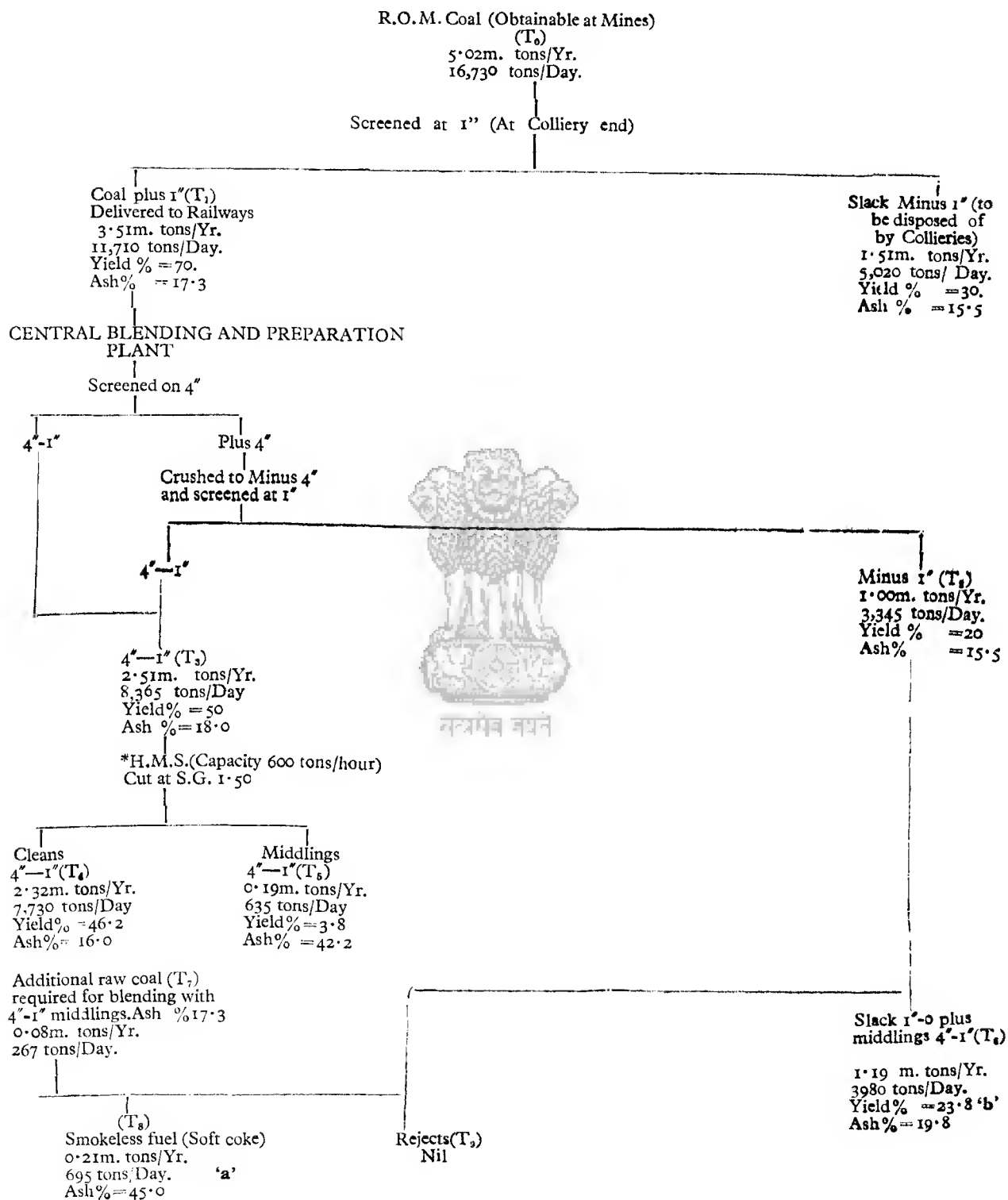
97. The Committee recommend that detailed schemes should be worked out immediately for setting up washeries at Anuppur, Junardeo and Kotha godium so that the washeries may be in commission by 1961-62. For this purpose, the Central Fuel Research Institute should be requested to undertake investigations without delay.



सत्यमेव जयते

[Flowsheets 1 to 5—at pages 77 to 81
Tables 48, 49 & 50—at pages 82 to 84]

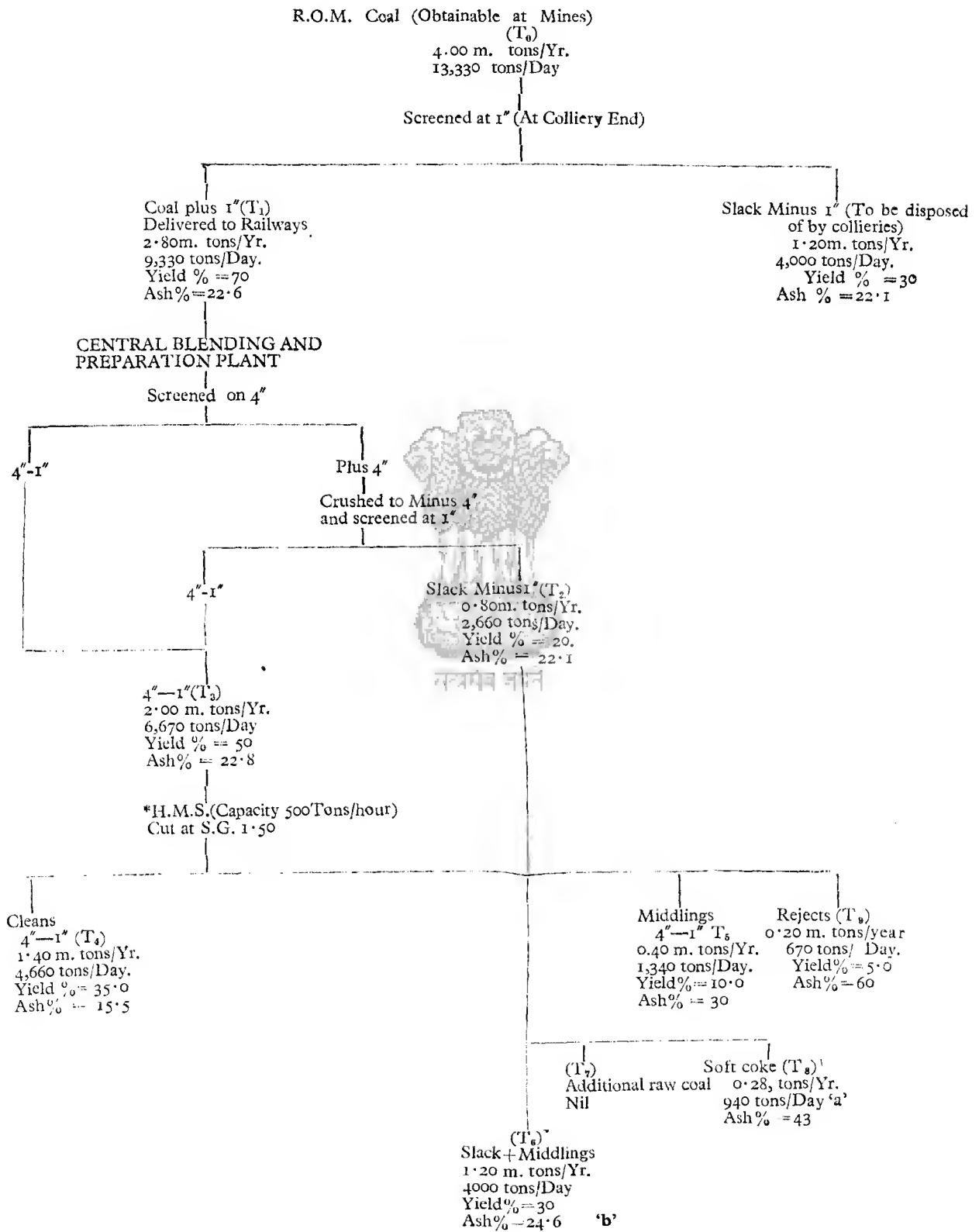
FLWSHEET 1
CENTRAL WASHERY FOR RAILWAYS AT ONDAL



*Heavy Medium Separator.

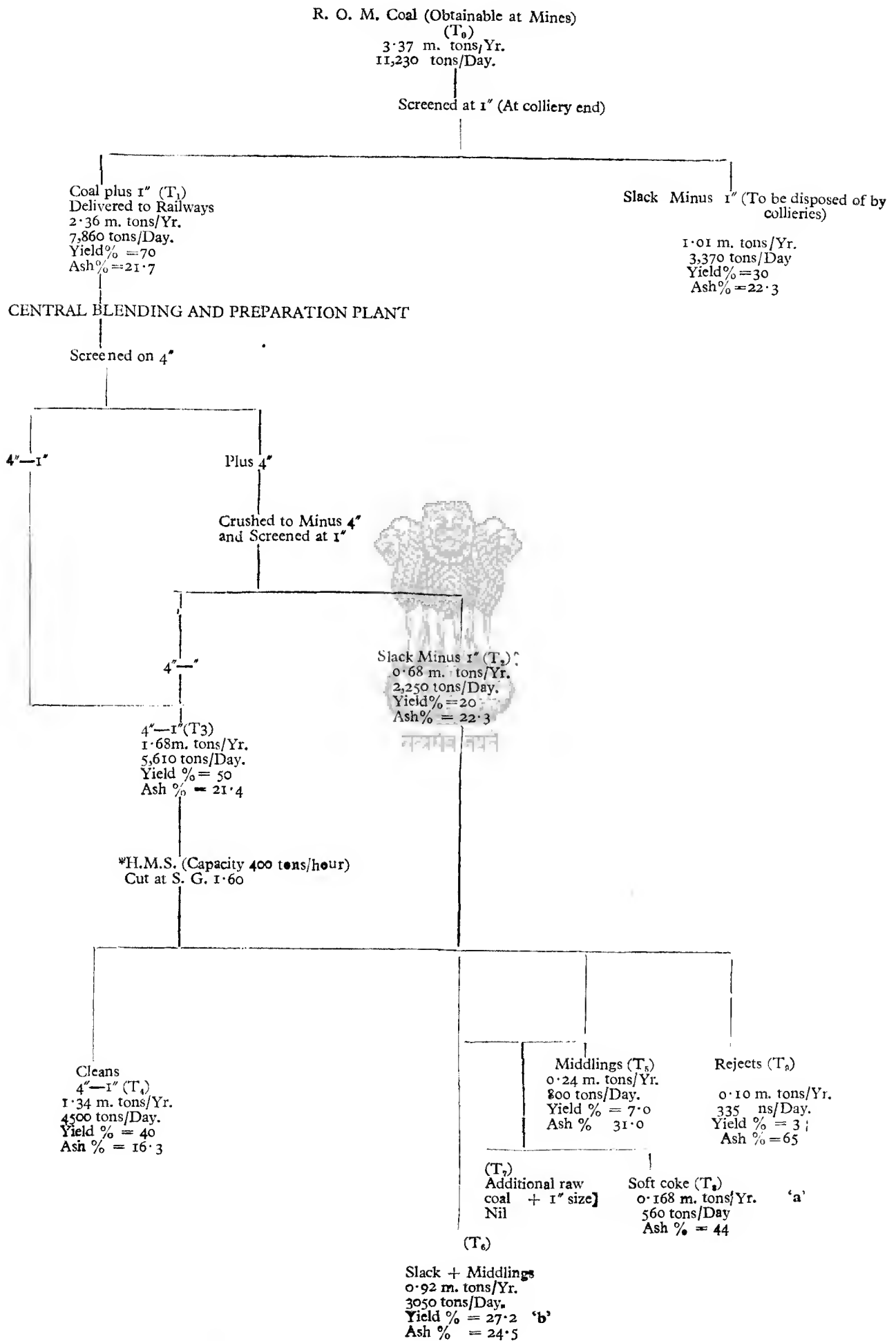
FLOWSHEET 2

CENTRAL WASHERY FOR RAILWAYS AT BARKAKANA



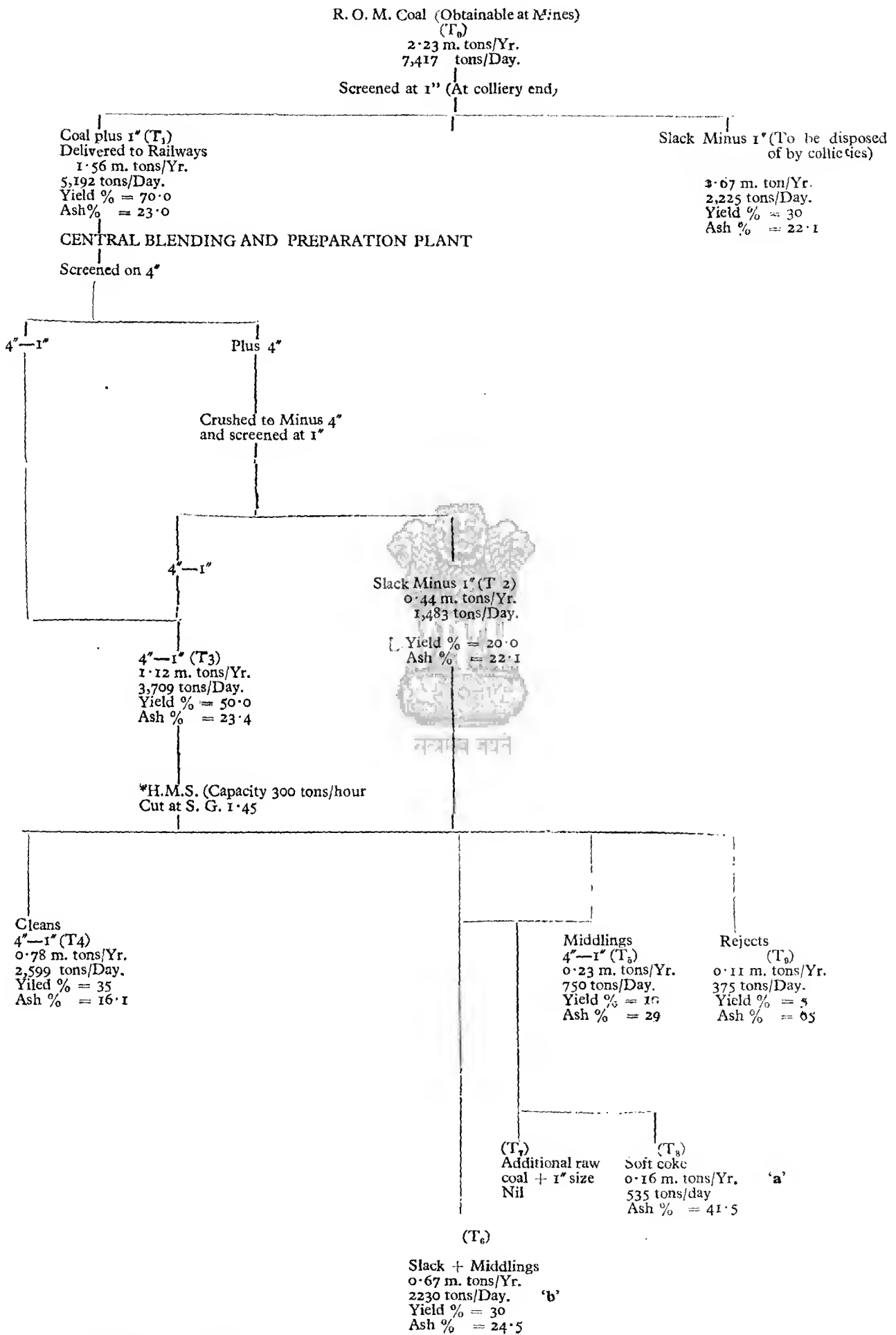
*Heavy Medium Separator.

FLOWSHEET 3
CENTRAL WASHERY FOR RAILWAYS AT ANUPPUR



*Heavy Medium Separator.

FLWSHEET 4
CENTRAL WASHERY FOR RAILWAYS AT 'UNARDEO



*Heavy Medium Separator.

FLWSHEET 5
CENTRAL WASHERY FOR RAILWAYS AT KOTHAGUDIUM

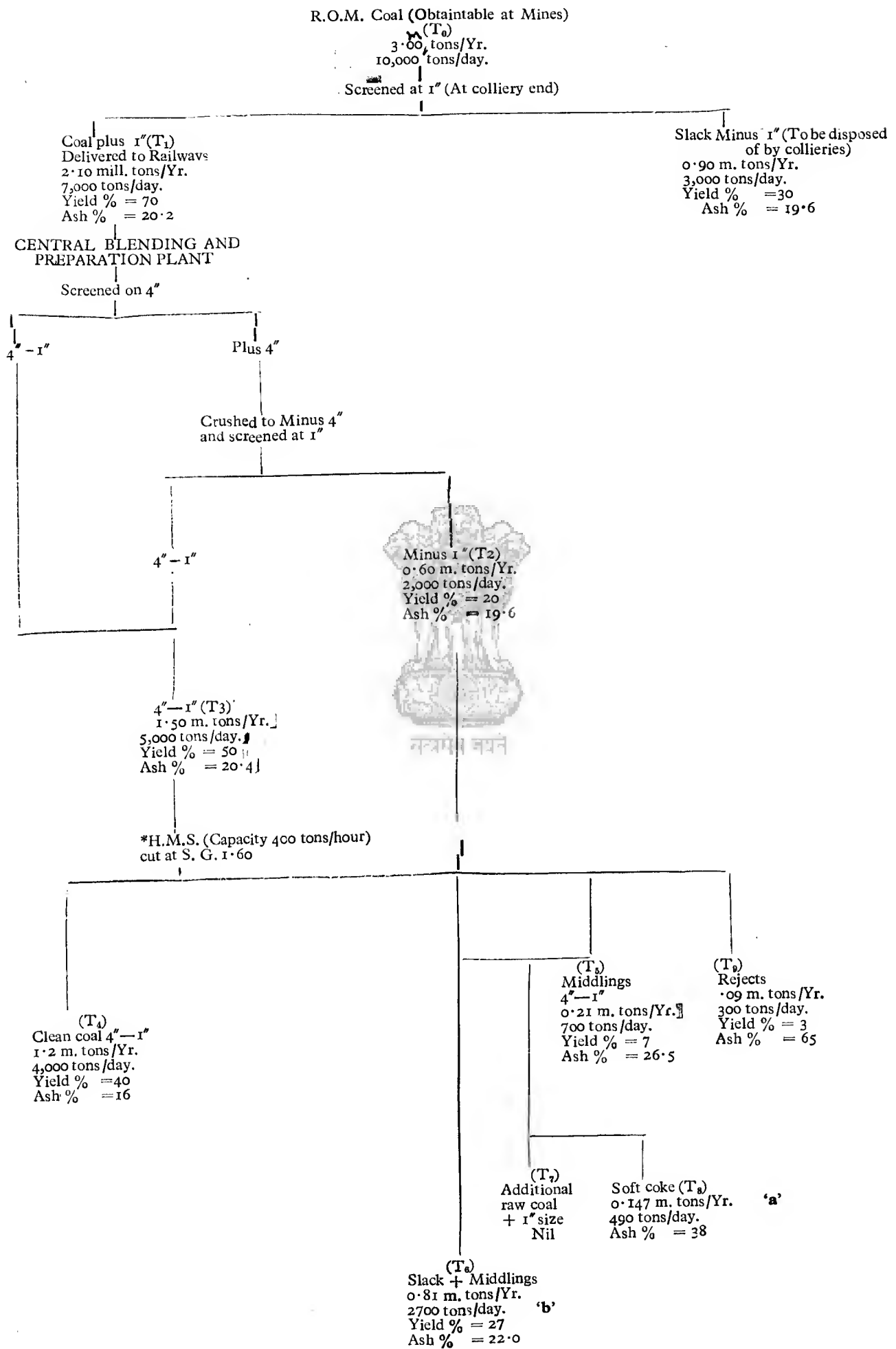


TABLE 49—*Economics of washing : Scheme 'B'*

Ondal		Barkakana	
1. Cost of 3.51 m. tons raw steam coal washed . . .	Rs. 67.14 m.	1. Cost of 2.8 m. tons grade II steam coal . . .	Rs. 53.86 m.
2. Selling price of slack blended with middlings 1.2 m. tons (19.8 % ash) @ Rs. 16.87 per ton . . .	Rs. 20.24 m.	2. Selling price of slack blended with middlings 1.2 m. tons (24.5 % ash) @ Rs. 16.25 per ton . . .	Rs. 19.50 m.
3. Net cost of 2.32 m. tons of washed coal . . .	Rs. 46.90 m.	3. Net cost of 1.4 m. tons of washed coal . . .	Rs. 34.06 m.
4. Corresponding requirements of unwashed coal from the same source (ash 17.3%) . . .	2.38 m. tons	4. Cost of unwashed coal required to substitute washed coal . . .	Rs. 27.90 m.
Cost of unwashed coal @ Rs. 17.94 per ton . . .	Rs. 42.69 m.	5. Extra expenditure involved . . .	Rs. 6.16 m.
5. Extra expenditure involved . . .	Rs. 4.21 m.	6. Less Savings from wagons released and additional earnings therefrom . . .	Rs. 3.57 m.
6. Less Savings from wagons released and additional earnings therefrom . . .	Rs. 1.34 m.	7. Net loss to Railways . . .	Rs. 2.59 m.
7. Net loss to Railways . . .	Rs. 2.87 m.		
Anuppur		Junardeo	
1. Cost of 2.36 m. tons. of coal washed . . .	Rs. 44.55 m.	1. Cost of 1.56 m. tons raw coal washed . . .	Rs. 29.45 m.
2. Selling price of .92 m. tons of blended slack (ash 24.5 %) & middlings @ Rs. 17.96 per ton . . .	Rs. 16.52 m.	2. Selling price of blended slack and middlings .67 m. tons (ash 24.5 %) @ Rs. 16.69 per ton . . .	Rs. 11.18 m.
3. Net cost of 1.34 m. tons of washed coal . . .	Rs. 28.03 m.	3. Net cost of .78 m. tons of washed coal . . .	Rs. 18.27 m.
4. Cost of unwashed coal required to substitute washed coal . . .	Rs. 26.20 m.	4. Cost of unwashed coal required to substitute washed coal . . .	Rs. 15.80 m.
5. Extra expenditure . . .	Rs. 1.83 m.	5. Extra expenditure . . .	Rs. 2.47 m.
6. Less Savings on account of less movement of wagons and additional earnings therefrom . . .	Rs. 1.96 m.	6. Less Savings on account of less movement of wagons and additional earnings therefrom . . .	Rs. 1.54 m.
7. Net gain . . .	Rs. 0.13 m.	7. Net loss to Railways . . .	Rs. 0.93 m.

Kothagudium

1. Cost of 2.1 m. ton of coal washed . . . Rs. 55.24 m.
2. Selling price of .81 m. tons (22% ash) of blended slack and Middlings @ Rs. 24.12 per ton . . . Rs. 19.54 m.
3. Net cost of 1.2 m. tons of washed coal (ash 16%) . . . Rs. 35.70 m.
4. Cost of unwashed coal required to replace washed coal . . . Rs. 32.80 m.
5. Extra expenditure . . . Rs. 2.90 m.
6. Less savings on account of less movement of wagons and additional earnings therefrom . . . Rs. 1.19 m.
7. Net loss . . . Rs. 1.71 m.

TABLE 50—*Operating Cost of a Washery per Ton of Coal Handled*

1. Capacity per hour	500 tons
2. Quantity of raw coal handled per annum (4000 hours per annum)	2 million tons
3. Capital cost (@ Rs. 30,000 per ton of raw coal per hour)	Rs. 150 lakhs
4. <i>Operating costs per annum</i>	
Interest per annum @ 4%	Rs. 6.00 lakhs
Depreciation @ 1/15	Rs. 10.00 „
Wages	Rs. 1.50 „
Consumable stores including requirements of sand etc.	Rs. 0.15 „
	<hr/> Rs. 17.65 lakhs
5. Cost of marketing and general administration. (@ 33 1/3% of operating cost)	Rs. 5.88 „
6. Total working costs	<hr/> Rs. 23.53 „
7. Cost per ton of raw coal washed (6÷2)	=Rs. 1.18 or Rs. 1/3/- per ton



CHAPTER XI

SCOPE FOR REDUCING COAL REQUIREMENTS BY ELECTRIFICATION AND DIESELISATION

98. In Chapter IX, an estimate of the requirements of coal for the Railways has been given. It will be noted that the requirements by the end of 1965-66 will be nearly double the present day consumption, and these requirements will increase progressively thereafter. It is obvious that if the Railways were to be run solely by steam traction in 1975, they would require very large quantities of coal and be saddled with the task of carrying this large quantity for their own use against about 14 million tons at present. Apart from the fact that adequate quantities of high grade steam coal will not be obtainable for steam traction, the movement of coal would not only present considerable difficulty but also reduce transport capacity for other traffic. To improve transport capacity, it will be necessary to increase the loads and speeds of trains progressively. For a given axle load, Diesel and Electric locomotives, which produce higher tractive effort than steam locomotives, can haul much bigger loads and at higher speeds. Recourse to diesel and electric traction is therefore inevitable to meet the future requirements of traffic.

In addition, diesel and electric traction give better thermal efficiency than does steam traction, and they also improve line capacity. The thermal efficiency of new designs of main line steam locomotives introduced on Indian Railways is about 6.4%, which is reduced to about 5.5% at the drawbar and is further reduced to about 4.5% because of consumption of coal on shed services, yard movements, etc. Using thermal power, the overall efficiency of electric locomotion is about 14%. Against this the overall thermal efficiency of diesel locomotion is about 22%. Further, as between diesel and steam traction, coal of average quality has a calorific value of 11,000 Btu/lb., while diesel oil has a calorific value of about 18,000 Btu/lb. The ratio of consumption of coal in steam traction to that of diesel oil in diesel traction thus works out to 8 : 1, i.e. $(22 \div 4\frac{1}{2}) \times (18,000 \div 11,000)$, i.e. one ton of diesel oil will do the work of 8 tons of coal. Similarly, coal consumption in steam traction as compared to that in electric traction works out in the ratio of 3 : 1, i.e. $(14 \div 4.5)$. In respect of shunting services, the overall efficiency of steam locomotives drops to 3% due to the boiler remaining in steam during idle hours. This results in the ratio of coal consumption to diesel oil consumption increasing to about 12 : 1 in shunting services.

The actual performance of diesel and steam locomotives hauling goods loads on Gaya-Gomoh section of the Eastern Railway has shown that, the consumption of coal in steam locomotives averages at 102.5 lb. per 1000 gross ton miles, and of oil in diesel locomotives operating the same services at 1.35 gallons, or 11.4 lb. per 1000 gross ton miles. Thus, the ratio of coal consumption in steam locomotives to oil consumption in diesel locomotives works out to 9 : 1 (i.e. $102.5 \div 11.4$), which is slightly higher than the theoretical ratio of 8 : 1.

Diesel Traction

Economics of Diesel Traction

99. The cost of diesel oil at present (1958) ranges from about Rs. 330/- at the ports to Rs. 380/- in the interior, averaging to Rs. 350/- per ton. Taking into consideration the average delivered cost per ton of coal (pithead costs

and freight charges) on the various Railways, the ratio of the cost of diesel oil to the cost of coal would be as in table 50.

TABLE 50 *Comparative Costs of Coal and Diesel Oil*

Railway	Average cost of coal per ton	Assumed cost of diesel oil per ton	*Ratio of diesel oil costs to coal costs
	Rs.	Rs	
Central . . .	39	360	9.2
Eastern . . .	27	350	13.0
Northern . . .	38	380	10.0
North Eastern . .	35½	380	10.7
Southern . . .	65	360	5.5
South Eastern . .	27	350	13.0
Western . . .	44½	360	8.1

*Losses due to quality of coal and present trends of prices indicate that the fuel costs ratios may be even lower.

Based on the consumption ratio of 8 : 1 for main line services, dieselisation on the Southern Railway appears to be justified for the entire Railway system. On the Western Railway, the fuel costs would be practically equal for steam and diesel traction, but in regions near the ports where the costs of coal would be higher and those of diesel oil lower, diesel traction should be more economical. As regards the Central, Northern and North Eastern Railways, the fuel costs ratio is not unduly adverse to the adoption of diesel traction. In regions near ports, diesel traction should prove still more favourable. So far as shunting services are concerned, diesel power for yard shunting would be generally justified on all Railways.

Fuel cost is only one of the important factors in train operation. A general analysis of the comparative costs of operation (excluding factors common to diesel and steam traction) has therefore been made for main line and shunting services on B.G. system to indicate the scope for diesel traction in different regions, vide Appendices 22(a) and 22(b). For purposes of broad comparison, this analysis would also apply to M.G. services. It can be concluded, by and large, that dieselisation of main line services can be extended to all regions where coal costs Rs. 36/- (or more) per ton and diesel oil costs Rs. 350/- (or less) per ton. Thus, the entire Southern Railway, the North-East Frontier Railway, the Saurashtra region of the Western Railway would admit of dieselisation on economic considerations. Over and above the economic considerations is the necessity for improved motive power and greater haulage and line capacity during development period, and dieselisation may be useful in the transitional phase. Large scale adoption of diesel traction is however, linked with the development of indigenous resources of diesel fuel and of technique for manufacture of diesel plant and equipment in the country.

100. Fuel oil requirements for diesel traction by 1965 are estimated as follows : under steam traction, the coal requirements for main line services would be about 23 million tons. Assuming that about 10% of main line trains are dieselised, the requirements of diesel fuel would be 0.3 million tons (one-eighth of 2.3 million tons of coal). The estimated consumption of coal on shunting services would be of the order of 3.5 million tons by 1965. Assuming that about 50% of the shunting services were dieselised during the intervening period, the requirements of diesel oil would be 0.15 million tons (i.e. $\frac{1}{12} \times 3.5 \times 0.5$ million tons). Thus, including main line services, the demand for diesel fuel on Railways alone in 1965-66 would be about

0.45 million tons. The present production of diesel oil from oil refineries in India is about 0.6 million tons per annum, which meets at present only a part of the country's needs. The lack of diesel oil from indigenous sources would thus handicap the development of diesel traction. It is therefore vital to increase indigenous resources for production of diesel oil progressively. There are three possible methods for doing so:—

- (a) The easiest method is to adopt new refinery practice to produce greater quantities of diesel oil from the crude, using for example catalytic hydrogenation. The projected development of natural crude oil and refinery capacities in Assam should be utilised to the maximum extent for production of diesel oil. It is also possible to hydrogenate (to diesel oil) the furnace oil now being produced in excess at existing refineries.
- (b) The second method of production of diesel oil is by hydrogenation of tar obtained as a by-product of (low-temperature) carbonisation process for manufacture of coke. For every ton of coke produced, about 0.1 ton of tar is available, which can be converted into diesel oil; 60% to 80% by weight, depending on the treatment adopted. The demand for domestic coke is expected to go up from the present level of 3 million tons to about 10 million tons by 1965. If low-temperature carbonisation process is increasingly employed for manufacture of domestic coke, it should be possible to produce 0.6 to 0.8 million tons of diesel oil from one million ton by-product tar.
- (c) The third method consists of direct gasification of coal and synthesis of gases to diesel oil. In this process, even inferior grade coal can be gasified for production of diesel oil.

In this connection, a note furnished by the Director, Central Fuel Research Institute, is presented as Appendix 23.

The production of diesel fuel by process (a) should be stepped up and Government should undertake pilot scale investigations to study technological and economic possibilities of applying processes (b) and (c) to Indian coals.

Maintenance of diesel equipment requires a high standard of skill. In the U.S.A., where diesel traction has replaced steam traction during the last 15 to 20 years, it is the usual practice to replace components at specified mileages; and as these are manufactured in the country, the maintenance costs are low—being about 50% of the maintenance costs of steam locomotives. This ratio of maintenance costs will not be achieved in India in the near future, and in addition there will be the burden of foreign exchange. This situation will continue until facilities for manufacture of diesel equipment are developed. The progress of diesellisation on Indian Railways is thus closely tied up with the early development of :

- (a) indigenous resources of Diesel oil ; and
- (b) indigenous design and manufacture of diesel plant and equipment.

Plans for design and manufacture of diesel equipment in the country should also take into account the future requirements of Defence Services, Agriculture, Road and Sea Transport etc. The overall national requirement of diesel oil and equipment justifies high priority being given to diesel technology and manufacture and to the increased production of oil fuels. This deserves the special attention of the Government.

Electric Traction

Economics of Electric Traction.

101. High acceleration and operating speeds, good train control, scope for multiple unit operation, and cleanliness and comfort are features common to both diesel and electric traction. Where electric traction scores is in simplicity of maintenance and in low maintenance costs, as no power generation on the locomotive is involved. In the development of electric traction, capital cost is high although cost of operation and maintenance is low. The cost of maintenance of electric locomotives is generally about a third of the maintenance costs of steam locomotives. But due to higher capital investment on electrification, low traffic densities militate against the adoption of electric traction.

An attempt has been made to correlate traffic density, cost of coal in rupees per ton and the cost of electric energy in annas per KWH for equalised overall operating costs of electric and steam traction. The data giving this correlation are presented in Appendix 22(a) and graph VIII at page 89.

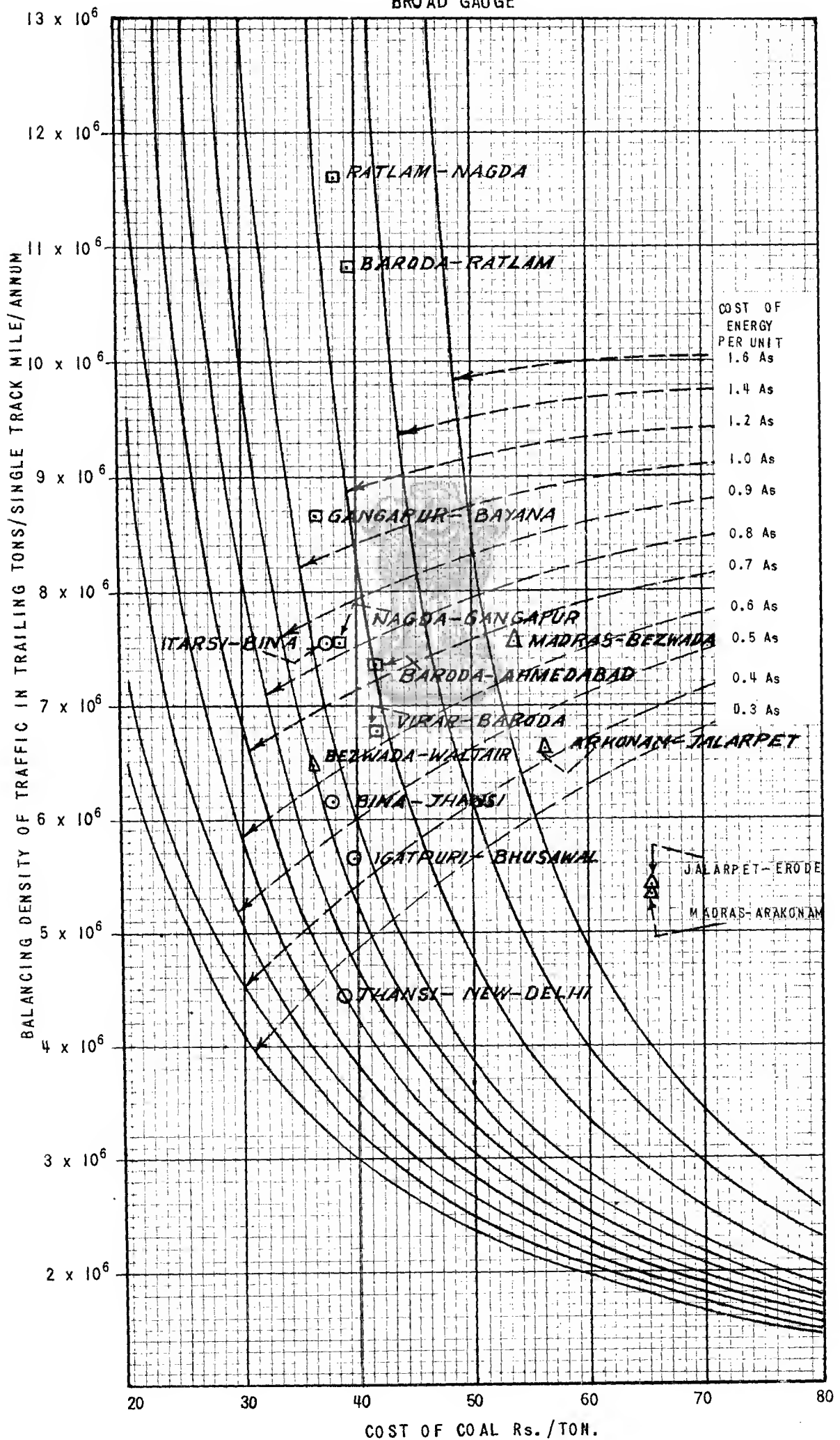
From this graph, it is possible to determine the maximum cost of electric energy which will justify electrification for given traffic density and cost of coal on a section. To illustrate the economics of Electrification the maximum cost of electric energy, and relative cost of coal and traffic density, for certain sections on the Central, Western and Southern Railways, is given in table 51.

TABLE 51—Maximum Cost Electric Energy Justifying Electrification

Section	Traffic density— Million Trailing Tons/ Track mile per annum	Cost of coal including freight	Maximum cost of electric energy which will justify electrifica- tion.
		Rs.	As/Unit
<i>Central Railway</i>			
1. Igatpuri-Bhusaval-Itarsi	5.67	39.46	0.95
2. Itarsi-Bina	7.55	37.41	1.06
3. Bina-Jhansi	6.17	37.92	0.94
<i>Western Railway</i>			
1. Virar-Baroda	6.79	41.92	1.16
2. Baroda-Ratlam	10.80	39.08	1.29
3. Ratlam-Nagda	11.62	38.10	1.27
4. Nagda-Gangapur	7.56	38.44	1.10
5. Gangapur-Bayana	8.64	36.51	1.10
6. Baroda-Ahmedabad	7.46	41.02	1.20
<i>Southern Railway</i>			
1. Madras-Bezwada	7.52	53.70	More than 1.60
2. Bezwada-Waltair	6.47	36.23	0.91
3. Madras-Arkonam	5.31	65.45	More than 1.60
4. Arkonam-Jalarpet	6.59	56.20	Do.
5. Jalarpet-Erode	5.39	65.45	Do.

As the average cost of electric energy drawn from electricity grids of different States is expected to be of the order of 0.65 anna per KWH, electrification of the sections given in the above table appears to be financially justified. However, due to high capital cost and to the present financial difficulties regarding foreign exchange, it may be feasible to adopt electrification only where it is inescapable as an operational necessity.

GRAPH VIII - MINIMUM TRAFFIC DENSITY TO JUSTIFY ELECTRIFICATION
BROAD GAUGE



Saving of High Grade Coals arising from Electrification.

102. Apart from economics, the other consideration in favour of electric traction is that it would reduce the requirements of high grade coals for Railways as thermal power on electric grids could be generated with low grade coals. Moreover, as stated in paragraph 98, the consumption of low grade coal would be only $\frac{1}{3}$ of that required for steam traction. Further, by 1960, the hydro power capacity will increase and is expected to be equal to the thermal capacity on the grid systems. The actual consumption of low grade coal to provide the power required for electric traction will then fall to about $\frac{1}{6}$ of the coal required for steam traction by the end of the Second Plan.

Thus, with progressive development of electric traction on Railways, not only will considerable quantities of high grade coals be released for other important industries, but also the transport so released will become available for public use.

Availability of Power.

103. Regarding the development of power grids, the installed capacity of hydro and thermal plants at the end of the First Plan was 2.7 million KW which will more than double itself by the end of the Second Five Year Plan as would appear from table 52.

TABLE 52—Existing and Proposed Capacities of Power Stations in different States.

State	Existing power stations (as on 30-12-57)		Proposed additional Power Stations in Second Plan	
	Thermal	Hydro (KW)	Thermal	Hydro (KW)
Andhra . . .	87,459	66,000	30,000	69,000
Assam . . .	..	8,400	12,000	..
Bihar . . .	177,500	64,000	105,000	40,000
Bombay . . .	450,250	278,800	247,000	250,000
Jammu & Kashmir	..	6,000	..	18,000
Madhya Pradesh	49,540	..	135,000	92,000
Madras . . .	89,000	165,150	230,000	285,000
Mysore . . .	..	215,200	..	96,200
Orissa . . .	5,000	123,000	..	109,500
Punjab . . .	..	144,000	..	498,000
Rajasthan . .	23,070	..	74,000	84,000
Uttar Pradesh .	224,335	76,100	112,000	390,000
West Bengal .	538,625	4,000	260,000	..
Kerala . . .	..	109,500	..	137,000
Delhi . . .	..	59,600	50,000	..
Total	1,644,779	1,319,750	1,195,000	2,068,700
Grand Total	2,964,529		3,263,700	

(Figures furnished by Central Water & Power Commission)

The power availability in the Third Five Year Plan should further increase with the development of thermal and hydro stations. As the demands for electrical energy generally tend to overtake the development of capacity, electrification of Railways will depend upon the availability of power. In planning the development of power, transmission lines and service stations, the Central Water & Power Commission should, therefore, ensure that the requirements of both Industries and Railways are fully covered.

In addition, the expansion of electrification will necessitate speedy development of projects connected with the manufacture of heavy electrical machinery and equipment. The Committee note that the Government have already taken steps to set up a plant for the purpose but more plants would be necessary to meet the expanding requirements of electricity grids and Railways.

Conclusion.

104. It will be observed from paragraphs 98, 99 and 101 that there is ample scope for adoption of diesel and electric traction on financial and operational grounds. Development of diesel traction is likely to be restricted by lack of indigenous resources of fuel and equipment which require long-term planning. So far as electric traction is concerned, steps have already been taken to set up a plant for manufacture of heavy electrical equipment, but progress of electrification will depend upon the availability of funds and electrical energy.

The Requirements and Utilisation Committee of the Coal Council have suggested that by 1975 50% of railway traffic should be handled by electrical power, 25% by diesel power and 25% by steam power. In view of the likely shortage of funds, of foreign exchange, and of indigenous resources in equipment and diesel fuel, the electrification and dieselisation of Railways may not develop to the above extent. The Committee, however, consider that endeavours should be made to reach a target of at least 30% electric traction, and 20% diesel traction by 1975. This will leave 50% of railway traffic for steam traction, which will require 27.5 million tons of coal (including 2.5 million tons for generating thermal power for electrification) against 50 million tons estimated earlier (para 96). Thus with 30% electrification and 20% dieselisation, the requirement of coal in 1975 will remain at about the same level as now estimated for 1965-66.

Recommendations.

The Committee recommend that:—

- A. Electrification should be undertaken as rapidly as foreign exchange, funds and availability of power permit, preference being given to sections on which high traffic density makes this step an operational necessity.
- B. To meet the future requirements of both industries and Railways, the Central Water & Power Commission should co-ordinate the planning of power development, transmission lines and service stations.
- C. Government should speedily develop adequate capacity for the manufacture of heavy electrical machinery and traction equipment.
- D. All shunting services should be progressively dieselised.
- E. Dieselisation of main line services should be introduced where it is necessary to improve line capacity, and electrification is not feasible.
- F. (i) High priority should be given to:—
 - (a) design and manufacture of diesel plant and equipment; and
 - (b) increased production of diesel fuel and lubricants.

- (ii) The existing refineries should step up production of diesel oil by conversion of furnace oil and the projected development of natural crude oil and refinery capacities in Assam should be utilised to the maximum extent for production of diesel oil.
- (iii) Government should undertake pilot scale investigations to study the technological and economic possibilities of the synthetic processes (b) & (c) referred to in para 100.

KARNAIL SINGH
Chairman

J. W. WHITAKER
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RÉSUMÉ

The Railways' expenditure on coal in 1956-57 was Rs. 442 millions (pithead costs plus freight) which is nearly 5 times the expenditure on coal in 1926-27. As the increase in the volume of traffic during this period has been only 66%, the rise in expenditure appears staggering. It is, however, in keeping with the general rise in price and wage levels in the country. The total working expenses of Railways which reflect both the rise in traffic and price levels have over these 30 years also increased five fold. The increase in expenditure on coal is therefore not an alarming factor.

The expenditure on coal is mainly determined by the cost per ton (pithead cost plus freight charges) and by the quantity of coal consumed—which in turn is related to the traffic moved. Since 1926-27, the expenditure on coal has risen by 374% while the average pithead price has risen by 220% and the delivered cost of coal (pithead price plus freight) by 141%; the quantity of coal consumed has risen over these 30 years by 96% and the volume of traffic by 66%. It is therefore abundantly clear that the rise in coal expenditure has been largely caused by the rise in coal prices and freight, and by the increase in traffic.

It is true that the consumption of coal has risen more rapidly than the traffic moved. Although the consumption of coal closely followed the volume of traffic from 1926-27 to 1940-41, it increased at a faster rate than the traffic from 1941 onwards due to the dislocation created by the Second World War. The gap between the rising trends of coal consumption and the volume of traffic became wider up to 1947-48; thereafter it was steady up to 1952-53, after which it has narrowed down showing gradual improvement. The various factors affecting expenditure on coal, including the reasons for more rapid increase in consumption since the war and for the subsequent favourable trends since 1952-53, have been examined by the Committee in detail.

Having regard to the dissimilar working conditions during the last 30 years and the far-reaching changes brought about by the Second World War, Partition, and the regrouping of Railways, a detailed comparison of the present performance with the distant past would not be appropriate nor useful for future control. A detailed study of the consumption trends during the years 1952-53 to 1956-57 has therefore been made to ascertain and to explain the present trends of performance. Analysis shows that while the traffic has increased by 27% since 1952-53, the coal consumption has increased only by 19·5%, showing improvement in fuel utilisation; but the expenditure has increased by 37·7% due to the progressive rise in the pithead prices and freight on coal. Of the total increase of Rs. 121 millions in expenditure on coal during these five years, nearly half is due to increase in pithead prices and freight rates, and the balance to increase in coal consumption.

An examination of the consumption rates in lb. per 1000 Gross Ton Miles, which is a measure of the efficiency of fuel performance on Railways shows that, since 1948-49 the consumption rates have shown a favourable trend. There has been a drop of about 6% in 1956-57 as compared to 1952-53 and this favourable trend is due to the effect of hauling heavier

loads and to the use of locomotives of higher efficiency. This improvement has taken place in spite of the disproportionate rise in engine hours in relation to the train miles.

Though there has been steady improvement in consumption rates during the last 8 years, they are higher as compared to pre-war years. One of the major factors responsible for this variation is the quality of coal. Since the beginning of World War II, there has been a rapid increase in the demands for coals and consequently deterioration in its quality. Trials have shown that coal consumption increases by 2% to 2.5% in steam locomotives for every 1% increase in ash. According to the assessment made by the Committee, the present fuel bill of Railways is higher by about 10% to 11% due to inferior supplies of coal. The coals supplied to Railways at present do not conform to the grades specified.

In addition to the availability and supply of better quality coals in pre-war years, the level of traffic was much lower than now, and train working conditions were much easier. These conditions made it possible to assign locomotives to individual crews, which ensured personal interest of the crew in their maintenance and upkeep. Moreover, there was better discipline making control over the performance of staff comparatively easy.

The adverse effect of inferior quality on consumption points to the necessity for improving supplies. As a large number of collieries supply coal to the Railways, effective check on the quality of coal loaded is, at present, well-nigh impossible. The position can be improved if the Railways have freedom to select collieries from which they obtain supplies, they set up their own Inspection Organisation to prevent loading of inferior coals by collieries, and are in a position to take direct action against the collieries which supply inferior coals.

While examining the question of quality, the Committee have gone into the present grading and price structure. The grading based on the tests carried out 10 years ago has now become out of date. Further, coals received from the Outlying Fields are ungraded and the Railways receive nearly 30% of their supplies from these sources which are generally of inferior quality. The need for grading these coals is urgent.

The present price structure allows a difference of about Re. 1 from grade to grade and of As. 3 only between coking and non-coking coals of the same grade. As the non-coking coals have lower calorific value than coking coals of the same grade, the consumers of non-coking coals are at a positive disadvantage. Moreover, there is a narrow difference in price of Selected Grade and Grade II coals which does not give to the consumers of lower grades, full value for their money.

The replacement of coking coals by non-coking coals in Railway supplies will adversely affect the Railways under the present price structure. The Railway expenditure on coal will rise appreciably as they will use only non-coking coals in the near future. The solution lies in rationalising the prices of coals on the basis of 'useful heat'.

Although the present consumption trend is favourable, there is scope for reducing coal consumption by exercising effective control on losses and wastages. Losses of coal occur from coal wagons in transit, from sheds, and from locomotives on line. Wastages arise in sheds from engines remaining in steam for long periods; excessive consumption on line results from mechanical de-

fects, from wasteful driving/firing technique or from wasteful use of engines leading to extra engine hours. The Committee made an endeavour to estimate the extent of losses and wastages arising from each individual factor, but in the absence of reliable data and due to the simultaneous operation of these factors, they were unable to do so. The overall wastages and losses (excluding transit losses) can however be determined by carrying out coal trials. The Committee conducted a series of coal trials which show a wide variation (4% to 18%) between the coal consumption found on trial and that recorded by the sheds for operating the same services with the same locomotives. The difference is indicative of losses and wastages occurring in sheds and on line.

For effective control over wastages in sheds, it is necessary to record the time spent in various shed services and to improve the method of estimation of coal consumption. Consumption 'on line' can be effectively controlled by fixing the target of consumption correctly while improvement in firing technique is possible by training of staff. Losses from sheds can be controlled by strengthening the security force, providing brickwalls round the sheds, and by taking strong disciplinary action against staff indulging in malpractices.

As regards transit losses, investigations have shown that while the collieries, by and large, load coal wagons correctly, a loss of about 1% takes place due to pilferage in transit. The extent of pilferage is not uniform; in certain areas the position is bad, justifying special preventive measures in collaboration with the State Governments.

Handling of coal costs the Railways about Rs. 10.5 millions per annum or 2.7% of the expenditure on coal. The bulk of the coal handling work is done departmentally on Central and Southern Railways, but by contract on other Railways. While the contract system has some merits, e.g. lower cost, flexibility in the supply of labour and less labour problems, it allows outsiders within shed premises, leading to leakages and thefts of coal. Even though it may cost more, there is advantage in replacing contract labour by departmental labour in sheds where pilferage of coal is heavy.

The handling of ashes and cinders costs the Railways about Rs. 30 lakhs per annum. The performance of this work by contract has become a regular and serious source of complaints against contractors and of loss to Railways. The contract labour generally indulges in malpractices by reclaiming larger quantities of cinders from ashes than stipulated, by showing sale of cinders to railway staff under spurious names, and by removal of coal and cinders with ashes. Replacement of contract handling of ashes and cinders by departmental handling is essential if the existing malpractices are to be rooted out.

Future supplies of Coal to Railways

The Railways consumed about 13.2 million tons of coal in 1956-57 out of the total production of about 45 million tons. By 1960-61, the railway requirements may go up to 16.5 million tons against the planned production of 60 million tons. By the end of the Third Plan, i.e. by 1965-66, the railway requirements are estimated to be 26 million tons whereas the total production is expected to reach 100 million tons.

The gradewise estimates of production show that the output of Selected Grade non-coking coals may be adequate to meet the railway requirements of 9 million tons in 1960-61; the output of Grade I coals will fall short of the railway requirements of 7.5 million tons. As a certain proportion of the coal supplied is found to be inferior to the specified grades, the actual gradewise supplies of coal are expected to be lower *viz.* 6 million tons Selected Grade and 4.3 million tons Grade I. This suggests that a real deficiency of the required grades of coal for Railway use will arise by the end of the Second Plan. The position will deteriorate further during the Third Plan.

To meet the shortages of high grade coals, it is therefore necessary to wash inferior coals, of which there is ample supply. The Central Fuel Research Institute has put up proposals for five washeries for Railways. Of these, three washeries *viz.* Anuppur, Junardeo and Kothagudium show promise of some net gain. If the planning of these washeries for Railway coal is taken up immediately, they can be brought into commission only by the end of 1960-61, and will afford relief in the Third Plan.

Beyond 1965-66 the consumption of coal will rise rapidly, and by 1975 the requirements of coal will be about 50 million tons—if all further increase in traffic is handled by steam power. Having regard to the limited resources of high grade coal in the country, it is problematic if production can be developed to meet this demand, and the Committee have therefore come to the conclusion that the Railway requirements of coal must be restricted to keep them at about the level forecast for 1965-66. This can be achieved by progressively replacing steam by diesel and electric traction. While the rate at which the Railways can be electrified and dieselised will depend upon the availability of funds, of foreign exchange, of indigenous resources of equipment and fuel (especially diesel fuel), the Committee consider that a target of 30% electrification and 20% dieselisation should be aimed at so that not more than 50% of Railway transport is worked by steam power by the end of 1975.

The introduction of diesel shunting is justified on economic grounds on all Railways. On Main line services, particularly in areas remote from collieries, where shortage of water is also a difficulty, dieselisation would be a desirable step. Electrification should be introduced on sections of Railways where traffic density is high making it an operational necessity.

To ensure rapid development of dieselisation, it is necessary that high priority be given to the indigenous design and manufacture of diesel plant and equipment, and to the increased production of diesel fuel and lubricants. Similarly, for electrification of Railways, the development of adequate capacity for manufacture of heavy electrical machinery and traction equipment is imperative. In addition, co-ordination in the planning of power development, transmission lines and service stations is essential to ensure supply of power to Railways and other industries.

SUMMARY OF RECOMMENDATIONS

S. No.	Recommendations	Reference to relevant para and page of the report.	
		Para	Page

CHAPTER III

Quality of coal:

1	The number of collieries from which coal for the Railways is drawn should be progressively reduced to facilitate inspection and control of quality. The target number to be achieved eventually may be taken as 250.	26	29
2	As loading of miscellaneous coal and dirt is now practised underground in the mines, it is essential that travelling picking belts should be provided on the surface to ensure efficient handling of shale and dirt and loading of coal to specified grades.	21	27
3	The Railways on their part should take immediate steps to set up an organisation for inspection of railway coal with a view to ensuring that the supplies are according to declared grades. The establishment of such an organisation is all the more urgent because the Railways will have to accept more and more non-coking coals in place of coking coals and the maintenance of quality is vital.	26	29
4	Railways should obtain their supplies by entering into contract with collieries and the contract should provide for penalties enforceable by Railways for failure to supply coal according to grade.	26	29
5	Coal quality surveys should be conducted twice a year by Railways preferably in collaboration with Central Fuel Research Institute.	27	30
6	The coals of Outlying Fields should be graded and suitably priced without any delay.	25	29
7	The present grading of Bengal and Bihar Coals, which is now over ten years old, should be revised.	25	29

CHAPTER V

Assessment of Losses and Wastages :

8	Reweighment checks of coal wagons at receiving sheds should be periodically carried out to keep a watch on transit losses.	40	43
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S. No.	Recommendations	Reference to relevant para and page of the report	
		Para	Page
9	The quantity of coal consumed in shed services should be assessed separately from that consumed in train working	42	44
10	The calibration of locomotive tenders should be improved to enable accurate assessment of tender balances.	42	44
11	The Railways should be fully equipped to carry out periodically coal trials for fixing correctly trip rations for various services so that coal consumption on line can be properly checked.	45	45

CHAPTERS VI & VII

Handling of Coal and Ashes

12	(i) All coal handling operations should be departmentalised in sheds where losses of coal by pilferage are heavy.	57	50
	(ii) Loading of coal on Engine tenders should be departmentalised in sheds where this is done mechanically.		
13	Mechanical loading should be introduced in all sheds where coal loading exceeds 70 tons per day.	52	48
14	Contracts relating to picking of cinders and handling of ashes should be terminated on Railways and departmental labour should be organised to handle the various operations as under:	62	52
	(i) Cleaning of ashpits and loading of ashes into trucks for dumping at nominated sites should be undertaken by departmental labour controlled by loco sheds.		
	(ii) Picking of cinders, screening and grading of ashes and disposal of cinders and ashes including utilisation for Railway purposes should be handled by departmental labour controlled by the Engineering department on Railways.		
15	At wayside stations, including traffic yards, all items of ash handling and cinder picking work should be under taken by the Engineering department.	62	52

S. No.	Recommendations	Reference to relevant para and page of the report	
		Para	Page
16	Experimental schemes should be organised by the Railway Testing & Research Centre to examine possibilities of large scale utilisation of ashes for construction purposes.	61	51
17	To save Southern Railway additional expenditure which they now incur in the supply of coal by sea, supplies of coal from Outlying Fields should be increased after steps have been taken to improve the quality of the coals produced in these fields.	65	53
18	The present contract arrangements for handling of Southern Railway coal at the Calcutta Docks should be terminated as early as possible and replaced by a departmental organisation under a Railway officer with sufficient commercial experience. He should be assisted by an experienced Senior Commercial Inspector and a Divisional Accountant in the management of the work now done by the shippers and in the settlement of monetary transactions relating to : (i) Payment of colliery bills ; (ii) Verification and adjustment of Railway freight charges ; and (iii) Prompt payment of Port dues and other charges in an authorised manner.	70	56
CHAPTER VIII			
Control Measures :			
19	To control the quality of coal supplies, Railways should have the same freedom to select collieries (in collaboration with the Coal Controller) as non-Railway consumers have.	73	57
20	The setting up of the Railway Inspection Organisation in accordance with the pattern indicated by the Committee should be expedited. (See S. No. 3)	74	57
21	Coal consumption on shed movement should be controlled by recording the time spent on shed services. (See S. No. 9)	75	58
22	Trip rations for train services and a scale of allowances for extra consumption due to out-of-course stoppages and detentions should be fixed on the basis of properly conducted trials	76	58

S. No.	Recommendations	Reference to relevant para and page of the report	
		Para	Page
23	Facilities for training of shed and running staff should be increased to improve the standards of locomotive maintenance and firing technique. Further, a review of the maintenance organisation on Railways is necessary to meet the requirements of rapidly increasing traffic and rolling stock holdings.	77	59
24	Investigations regarding the specifications of lubricating cylinder oils should be finalised as early as possible.	44 (Chap. V)	45
25	Co-operation of the State Governments should be sought to regulate the sale of steam coal only through licensed dealers so that local authorities can question the sources of supply by examining their accounts and other means in the event of any malpractices being suspected.	78	61
26	The strength of Security Force which the Railways consider inadequate for keeping a watch over coal stacks in sheds and over loaded coal wagons standing in open yards, should be suitably augmented without delay; armed guards should be posted in sheds and yards as a drive against pilferage where necessary	78	61
27	Although the expenditure on the provision of brick walls to prevent the entry of outsiders into loco sheds is heavy it is amply justified at sheds where pilferage is found to be heavy.	78	61
28	Severe disciplinary action should be enforced against drivers and other staff wherever reasonable evidence is forthcoming regarding their indulgence in the stopping of trains at vulnerable points and other malpractices leading to leakage of coal.	78	61
29	Fuel Organisations on Railways should be suitably strengthened to implement the control measures on the lines.	79	61
30	A centralised system of linking 'missing' and 'unconnected' wagons should be introduced as a safeguard against possible losses of complete wagon loads.	80	62
31	Initial compilation of coal and operating statistics should be decentralised to Divisions to facilitate exercise of better control by local authorities.	81	63

S. No.	Recommendations	Reference to relevant para and page of the report.	
		Para	Page
32	Before compilation of coal consumption statistics there should be a general reconciliation between the figures of coal consumption and issues of coal by sheds to locomotives	81	63
33	The Railways should compile and publish statistical data relating to coal consumption separately for the following services :— (i) <i>Passenger Services</i> : (a) Mail and Express (b) Passenger and Parcel (c) Local and Suburban (d) All Passenger (e) Proportion of mixed (f) Passenger and proportion of mixed (ii) <i>Goods Services</i> : (a) Through Goods (b) Pick-up and Van Goods (c) All Goods (d) Proportion of mixed (e) Goods and proportion of mixed	81	64
CHAPTERS IX & X			
34	Coal Beneficiation & other Measures :— (i) In order to guarantee reliability and uniformity in quality of future supplies, the time is ripe for the establishment of washeries in certain fields to upgrade non-coking coal ; and (ii) In order to counteract any fall in the hauling capacity of locomotives during the present difficult period, mechanical stokers should be fitted to heavy goods locomotives as far as practicable even though coal consumption may go up.	89	69
35	Detailed schemes should be worked out immediately for setting up washeries at Anuppur, Junardeo and Kothagudium so that the washeries may be in commission by 1961-62. For this purpose, the Central Fuel Research Institute should be requested to undertake investigations without delay	95	74
CHAPTER XI			
Electrification and Dieselisation :			
36	Electrification should be undertaken as rapidly as foreign exchange, funds and availability of power permit, preference being given to sections on which high traffic density makes this step an operational necessity	101	88

S. No.	Recommendations	Reference to relevant para and page of the report	
		Para	Page
37	To meet the future requirements of both industries and Railways, the Central Water & Power Commission should co-ordinate the planning of power development, transmission lines, and service stations.	103	90
38	Government should speedily develop adequate capacity for the manufacture of heavy electrical machinery and traction equipment.	103	91
39	All shunting services should be progressively dieselised.	99	86
40	Dieselisation of main line services should be introduced where it is necessary to improve line capacity and electrification is not feasible.	99	86
41	(i) High priority should be given to — (a) Design and manufacture of diesel plant and equipment, and (b) Increased production of diesel fuel and lubricants (ii) The existing refineries should step up production of diesel oil by conversion of furnace oil and the projected development of natural crude oil and refinery capacities in Assam should be utilised to the maximum extent for production of diesel oil. (iii) Government should undertake pilot scale investigations to study the technological and economic possibilities of the synthetic processes (b) & (c) referred to in para 100.	100	87

APPENDIX No. 1 (a)
GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS
(RAILWAY BOARD)

No. E57Co1/133/RBI.

New Delhi, dated 5th November, 1957.

To

The Financial Adviser and Chief Accounts Officer, Northern Railway, New Delhi.

Re : APPOINTMENT OF AN EXPERT COMMITTEE TO EXAMINE THE INCREASED COST OF FUEL CONSUMPTION ON RAILWAYS.

The sanction of the President is communicated to the appointment of a Committee consisting of the following officers to examine the increased cost of fuel consumption on Railways and for planning the Railways' requirements of high-grade coal during the next few years :—

- | | |
|-----------------------------------------------------------------------------|-------------------------------------|
| (1) Shri Karnail Singh, Member, Engineering, Railway Board | Chairman. |
| (2) Shri R. Krishnaswamy, Director, Mechanical Engineering, Railway Board | Member. |
| (3) Director, Transportation (T), Railway Board | Member. |
| (4) Shri J.W. Whitaker, O.S.D. (Mining Research), C.S.I.R., New Delhi. | Member. |
| (5) Shri P. M. Nayak, I.C.S. Coal Controller, Calcutta | Member. |
| (6) Shri D. P. Mathur, now Sr. Dy. General Manager, Central Railway, Bombay | will be whole-time Member-Secretary |

The Joint Director, Mechanical Engineering, (Coal), Railway Board, will be available to the Secretary for any technical assistance throughout.

2. The terms of reference of the Committee will be as follows:—

To examine and to report on the factors responsible for increase in railway expenditure on coal, commenting particularly on—

- (i) the extent to which the quality of coal is responsible for increase in consumption and expenditure and for poor performance ;
- (ii) the expenditure incurred on handling charges keeping in view the lead and lift involved ;
- (iii) the comparative merits and demerits of employing departmental or contract labour for coal handling ;
- (iv) the causes and quantum of wastage and losses of coal in transit, in sheds and otherwise ;
- (v) the extent to which the increase in expenditure on coal is due to increase in traffic , coal prices, freight charges on coal, etc.

II. To examine the Railways' future requirements of high grade coal for steam traction and the prospects of adequate supplies and to recommend measures for meeting and anticipated shortages.

3. The Committee will endeavour to submit the report within a period of 4 months from 1st November, 1957.

4. The Headquarters of the Committee will be at New Delhi.

5. The Chairman and the Members of the Committee will be eligible for travelling facilities and will be paid travelling allowance in accordance with the rules applicable to their respective services.

6. The Chairman and the Members of the Committee will be their own controlling officers for purposes of T.A. etc.

7. You will function as Accounts Officer of the Committee and the D.A.O., Northern Railway, New Delhi, will be the disbursing officer.

8. Sanction is communicated to the creation of a post of Officer-on-Special Duty on the scale of pay Rs. 2,500—100—3,000/ Rs. 1,800—2,250 P.S. for a period of 4 months from the date it is filled.

The expenditure is debitable to Grant No. 2, Miscellaneous Railway Expenditure, Annexure E, Item 2.

Sd/- R. E. de Sa,
Secretary, Railway Board.

No.E57Co1/133/RBI.

NEW DELHI, 5TH NOVEMBER, 1957.

Copy forwarded for information to :—

1. All General Managers, Indian Railways.
2. Ministries of Steel, Mines and Fuel and Education and Scientific Research.
3. Secretary and Director-General, Council of Scientific and Industrial Research, New Delhi.
4. Shri Karnail Singh, Member Engineering, Railway Board.
5. Shri R. Krishnaswamy, Director, Mechanical Engineering, Railway Board.
6. Director, Transportation (T), Railway Board.
7. Shri J.W. Whitaker, O.S.D. (Mining Research), C.S.I.R., New Delhi.
8. Shri P. M. Nayak, I.C.S., Coal Controller, Calcutta.
9. Shri D. P. Mathur, Sr. Dy. General Manager, Central Railway, Bombay.
10. J.D. M.E. (Coal), Railway Board.
11. Budget, Works, E(A.O.), E (R.BII), Cash, G and Coal Branches of Railway Board.

Sd/- R. E. de Sa,
Secretary, Railway Board.

No. 57COI/133/RBI

NEW DELHI; 5TH NOVEMBER, 1957.

Copy forwarded to Chief Auditor, Northern Railway and A.D.A.I. (Railways).



Sd/- Y.T. SHAH,
for Financial Commissioner, Railways.

APPENDIX No. 1(a)—Concl'd.

GOVERNMENT OF INDIA

MINISTRY OF RAILWAYS

(RAILWAY BOARD)

No. E57COI/133/RBI

New Delhi, the 8th February, 1958.

To

The F.A. & C.A.O.,

Northern Railway.

SUBJECT.—*Appointment of an Expert Committee to examine the increased cost of fuel consumption on Railways.*

In continuation of Railway Board's letter No. E57COI/133/RB-I dated 5th November 1957, the sanction of the President is communicated to Dr. A. Lahiri, Director, Central Fuel Research Institute, Jealgora, being co-opted as an additional Member of the above Expert Committee.

2. Dr. Lahiri will be eligible for travelling facilities and will be paid Travelling Allowance in accordance with the rules applicable to him in his own department. He will be his own Controlling Officer for purposes of T.A. etc., as the other members of the Committee.

Sd/- R. E. de Sa,

Secretary, Railway Board.

No.E57COI/133/RB-I.

DATED THE 8TH FEBRUARY 1958.

Copy forwarded for information to :—

1. All General Managers, Indian Railways.
2. Ministries of Steel, Mines and Fuel and Education and Scientific Research.
3. The Director General, Council of Scientific & Industrial Research, New Delhi with reference to his letter No. 2/4(4)/56 PC dated 21st January 1958.
4. Shri Karnail Singh, Member, Engineering, Railway Board.
5. Shri R. Krishnaswamy, Director, Mechanical Engineering, Railway Board.
6. Shri Ratan Lal, Director Transportation (T), Railway Board.
7. Dr. A. Lahiri, Director, Central Fuel Research Institute, Jealgora.
8. Shri J. W. Whitaker, O.S.D. (Mining Research), C.S.I.R., New Delhi.
9. Shri P. M. Nayak, I.C.S., Coal Controller, Calcutta.
10. Shri D. P. Mathur, Member-Secretary, Expert Committee on Fuel Consumption, State Entry Road, New Delhi.
11. J.D.M.E. (Coal), Railway Board.
12. Budget, Works, E (A.O.), E (R.B II) Cash, G and Coal Branches of Railway Board.

Sd/- R. E. de Sa,

Secretary, Railway Board.

APPENDIX No. 1 (b)

EXPERT COMMITTEE ON COAL CONSUMPTION ON RAILWAYSQUESTIONNAIRE**I. Supplies and Consumption of Coal.**

(1) What has been the annual expenditure on coal on your Railway during the years 1954-55 to 1956-57. A break-down of the expenditure in each year should be given as under —

- (a) The quantity, price per ton and the cost of coal, grade-wise,
- (b) freight charges incurred,
- (c) handling charges on loading, stacking and re-loading of coal incurred in each shed distributed under the various operations carried out, manually or mechanically, indicating the quantities handled in each shed, and
- (d) incidental expenditure, if any.

Furnish information in *Proforma* I attached.

(2) What demands of coal for various grades were made by your Railway on the Coal Controller in each of the years 1954-55 to 1956-57, indicating the basis of assessment.

(3) What was the quantity of coal consumed by each Railway grade-wise during the years 1954-55 to 1956-57 on various services? (*proforma* No. 2 attached).

(4) What are the quantities of various grades of coal supplied from the various collieries to your Railway during 1954-55 to 1956-57? The base station against each colliery from which despatches were made may also be indicated. (*Proforma* No. 3 attached).

(5) What was the number of individual collieries that met the requirements of coal of each shed month by month on your Railway during 1956-57?

II. Quality Control.

(6) What are the present arrangements made by the Coal Controller's Organisation to ensure that the quality of coal supplied to Railways is of a suitable grade and specification for loco purposes? Also indicate the strength of the Inspection Organisation and distribution of staff over different fields.

(NOTE —According to the loco coal programme, 500 to 600 collieries are allocated loco orders. Out of these, how many loading points are actually checked daily for quality by the Coal Controller's Inspection Branch and what is the percentage of wagons checked every day against the total wagon supplies?).

(7) What checks do the Railways exercise on the quality of coal received by them? How many samples are drawn and analysed each month for grade-check? Are the existing facilities adequate for grade-checking at the rate of one sample for every 1000 tons of coal received? If not, what additional testing facilities are required by way of staff and equipment with estimated costs?

(8) How many complaints were made by your Railway to the Coal Controller during the last three years *annually* regarding defective supplies of coal? In how many cases action was taken by the Coal Controller to set matters right? Action on how many complaints was outstanding on 1-4-1954, 1-4-1955, 1-4-1956 and on 1-4-1957? (*Proforma* No. 4 attached).

III. Coal Handling.

(9) What are the various items of work connected with coal handling (as distinct from ash and cinder handling), which are undertaken on contract and also items done departmentally in the various sheds of your Railway?

(10) Give the cost of the various items of coal handling work carried out *in each shed* on contract as well as departmentally. In respect of items done on contract what would be the estimated cost, if handled departmentally? (*Proforma* No. 5 attached)

(11) Is the contract system of handling supplies of coal found to work better than departmental system and if so, on what grounds? State also the weaknesses of the contract and departmental systems indicating your preferences clearly.

IV. Ash and Cinder Handling.

(12) What are the items of work connected with the handling of ash and cinders carried out on contract and items of work done departmentally—shed-wise. Forms of contracts/agreements used may be supplied.

(13) What are your views regarding the merits and demerits of working different items under contract or departmentally?

V. Accountal of Coal Receipts and Issues (consumption).

(14) Detail the procedure, sending the forms used, in the sheds for recording issues of coal to locos ensuring a continuous check over the receipts, issues and balances.

APPENDIX No. 1 (b)-(contd.)

(15) On receipt of wagon supplies, are coals of various grades stacked gradewise and colliery-wise? Are coal stacks properly made and issues made only from such stacks? If not, detail alternative methods adopted indicating how control over receipts, issues and balances is exercised?

(16) What arrangements exist for the issue of coal to locos from stacks—manual or mechanical—shedwise? Give reasons for the methods adopted.

(17) What are the methods of assessing the quantity of coal issued to locomotives? Are the present methods satisfactory? If not, give suggestions for effecting improvements.

(18) What was the percentage quantity *actually* found short in each shed, and for the Railway as a whole, at the end of each of the three years 1954-55 to 1956-57?

(i) How much of this shortage was within permissible limits? (indicate permissible limits).

(ii) What percentage of shortage was above permissible limits?

(19) Give a statement of trip rations fixed for different services in each Division of your Railway, giving particulars of locos, range of loads and grades of coal used in the attached *proforma* No. 6.

(20) What is the percentage of coal wagons weighed on receipt on the Railway? The results of weighments made during the last one year may be indicated for the sheds concerned.

VI. Southern Railway Coal.

(21) What quantities of coal of different grades were received by Southern Railway from Bengal and Bihar coal fields.

(i) by rail route;

(ii) by rail-cum-sea route;

during each of the years 1954-55 to 1956-57.

(22) What was the freight paid for supplies of sea borne coal in each of these years broken up into :

(i) sea freight; and

(ii) rail freight?

(23) What is the freight paid on rail-borne coal to Southern Railway from Bengal and Bihar coal fields?

(NOTE :—*Proforma* No. 7 for questions No. 21 to 23 attached).

(24) What quantities of coal were received by Southern Railway from outlying fields during each of the years 1954-55 to 1956-57?

(25) What is the freight paid for rail borne coal from the various outlying fields separately in each of these years giving figures for supplies from each field?

(NOTE :—*Proforma* No. 8 for question Nos. 24 & 25 attached).

(26) In case of sea-borne coal, are wagons weighed on unloading from bunkers, and if so, what differences have been noted between quantities invoiced and quantities reloaded into wagons and weighed for the years 1955-56 and 1956-57?

(27) What losses have been found on weighment of the wagons at sheds representing transit losses in the journey from receiving docks to the destination sheds? Give total transit and handling losses on sea-borne coal upto the point of receipt in sheds as compared with invoiced weights.

(NOTE :—*Proforma* No. 9 for question Nos. 26 & 27 attached).

VII. Missing Wagons.

(28) What was the number of wagons consigned from colliery base stations to your Railway during the years 1954-55 to 1956-57 and how many were actually received at the sheds?

(29) How many wagons were found to be missing annually during the years 1954-55 to 1956-57? Out of the missing wagons how many were subsequently traced (within a month, within three months and after three months)?

(30) How many wagons remained untraced? What were the debits raised in respect of such wagons against the Commercial Department in these three years?

(31) What was the quantity and value of coal in the missing wagons (not traced in each of the years 1954-55 to 1956-57)?

(NOTE :—*Proforma* No. 10 for question Nos. 28 to 31 attached).

(32) What is the number of coal wagons accounted for by the sheds which were not specifically consigned to your Railway? What is the value of such coal accounted for?

(33) What is the value of compensation paid to private parties by the Claims Organisation in respect of coal wagons not received by the original consignee?

(34) Has the position regarding missing wagons improved since the introduction of the new system of fuel accounting? If not, what difficulties are at present being experienced in connecting actual supplies with despatches?

APPENDIX No. 1 (b)-(contd..)

VIII. Factors contributing to increase in consumption of coal.

(35) What increases have been allowed in the pithead prices of coal grade-wise from 1950-51 onwards upto date?

(36) What increases in freight rates have taken place from 1950-51 upto date?

(37) What has been the effective increase in expenditure per ton of coal due to the rise in (a) price of coal and (b) freight charges on your Railway since 1950-51? *Proforma* No. 11 for question Nos. 36 & 37 attached).

(38) State the quantities of the correct grades of coal assigned to various groups of services such as mail trains, slow passengers, goods etc., and the consumption and costs of correct and the lower grades of coal against each group as per *proforma* No. 12 attached.

(39) What train miles, engine miles and gross ton miles were operated on your Railway by the various service groups during the years 1950-51 to 1956-57 indicating percentage increases from year to year taking the figures for the year 1950-51 as the base.

(40) What was the rate of consumption of coal in lbs. per 1000 gross ton miles in each of the years 1950-51 to 1956-57 for mail and express, passenger, shuttles, locals, all passengers, mixed, through goods, pick up and van goods, and all goods. Give figures for shunting and departmental services separately in lbs. per engine mile for the years 1950-51 to 1956-57.

(41) What were the number and types of loco motives in use divided in age groups on passenger, goods, mixed, shunting and departmental services during the years 1954-55 to 1956-57.

(NOTE :--Furnish information in *proforma* No. 13).

(42) How much of Gr. I and Gr. II coal was received from Bengal & Bihar fields during the years 1954-55 to 1956-57? How much ungraded coal was received from outlying fields estimated to be equivalent to Gr. I and II and of lower grades on the basis of grading applicable to Bengal and Bihar fields for the years 1954-55 to 1956-57.

IX. Future Requirements and Prospects of Supplies.

(43) What is the present production of various grades of coal in Bengal and Bihar fields (coking and non-coking) and the present production of equivalent grades of coal in the outlying fields?

(44) How much additional coal of various grades (coking and non-coking) is proposed to be raised field-wise by the end of the 2nd and 3rd Five Year Plans?

(45) What are the railway requirements of coal of various grades by the end of 1960-61 and at the end of 1965-66, keeping in view the need for intensive utilisation of loco power?

(46) What is the present and estimated shortage at the end of 1960-61 and 1965-66 of high-grade coals which would adversely affect the full utilisation of loco power?

(47) What measures are necessary to meet the shortages, long-term and short-term?

(48) What is the average lead of coal received by Railways from (a) Bengal & Bihar, (b) C.I.C. and Chanda, (c) Singareni coal fields?

(49) What are the results of the rapid quality survey of coal made by various Railways? Does it support the statement that a general deterioration has taken place in the quality of coal produced in the country involving a general drop by one grade? If so, estimate the loss incurred by your Railway on this account.

(50) What is the basis of the present price structure for coal? Is it rational from the consumer's point of view? If not, what are the anomalies and what method of rationalisation is contemplated?

(51) On the basis of the present price structure, if Grade II coal were to be replaced by higher grade coal, what economy in transport, freight and costs would be realised?

(52) What have been the total grade-wise demands and despatches of coal for various industries in each State during 1955-56 and 1956-57. The demands and despatches of different grades of coal on account of Railways, bunker, export etc., may be shown separately to work up to total demands and despatches of coal in the country. To what extent the coal demands shown on the above lines are likely to increase by the end of 1960-61 and by the end of 1965-66?

X. Coal Transport.

(53) What is the pattern of coal traffic connecting the various base stations in the coal fields with important Railway junctions? Information regarding the number of wagons required to be moved from the base station to the connecting junctions on Railways for loco and non-loco supplies as well as quotas fixed for junctions should also be clearly furnished.

(54) What expansion in line capacities and junction yards is necessary to meet the present demands of coal which, it is understood, are in excess of the actual despatches?

(55) What are the steps being taken by Railways to remove the present bottlenecks?

(56) What extra line capacities and junction capacities are suggested to meet the demands of coal traffic by 1960-61 and 1965-66?

(57) What are the plans for developments of junction and line capacities to meet the requirements of extra coal traffic arising by 1960-61 and 1965-66?

APPENDIX No. 1 (b)-(contd.)

XI. Technological Development.

(58) What investigations have been carried out by the Fuel Research Institute to study washability characteristics and economics of washing non-coking coals? Proposals for suitable washeries based on available results may be submitted with estimates of initial and recurring costs relative to the sources of supply and capacities of the plant.

(59) The railway requirements for high grade non-coking coals are expected to be of the order of 16 million tons in 1960-61 and 20 million tons in 1965-66. How could these requirements be met from the Bengal & Bihar coalfields as well as outlying fields by the application of appropriate technological methods?

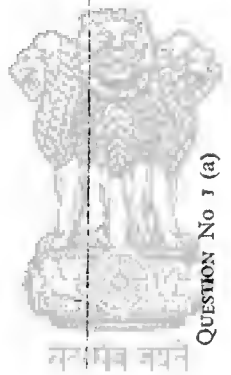
(60) What are the technical possibilities of blending non-coking coals raised in different coalfields to ensure supply to Railways of standard qualities with ash (in low moisture coals) not exceeding 18 to 20% and ash (in high moisture coals) not exceeding 14 to 16%. Any specific proposals formulated in this connection may be detailed for information.



APPENDIX No 1 (b)-(contd.)
 PROFORMA No. 1
 QUESTION No 1

Proforma 1 (a)—Quantity, Price per Ton, and Cost of Coal Grade-wise—Question No. 1 (a)

STEAM COAL														OTHER COAL							
Year	Sel. A			Sel. B			Grade I			Grade II			Ungraded			Total		Rubble			
	Qty.	Price per ton	Pithead cost	Qty.	Price per ton	Pithead cost	Qty.	Price per ton	Pithead cost	Qty.	Price per ton	Pithead cost	Qty.	Price per ton	Pithead cost	Average Price per ton	Qty.	Price per ton	Pithead cost.		
1954-55	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1955-56																					
1956-57																					
I																					
	Tons.	Rs. Np.	Rs.	Tons.	Rs. Np.	Rs.	Tons.	Rs. Np.	Rs.	Tons.	Rs. Np.	Rs.	Tons.	Rs. Np.	Rs.	Tons.	Rs. Np.	Rs.	Tons.	Rs. Np.	Rs.



Proforma No. 1 —Contd.

OTHER COAL										COKE									
Slack			Dust			Hard coke Gr. I quality			Soft coke			Smithy nut Gr. I quality			Total other coal and coke			Grand Total	
Qty.	Price per ton	Pithead cost.	Qty.	Price per ton	Pithead cost	Qty.	Price per ton.	Pithead cost	Qty.	Price per ton	Pithead cost.	Qty.	Price per ton.	Pithead cost.	Qty.	Pithead cost.	Qty.	Pithead cost	
23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	
Tons.	Rs. Np.	Rs.	Tons.	Rs. Np.	Rs.	Tons.	Rs. Np.	Rs.	Tons.	Rs. Np.	Rs.	Tons.	Rs. Np.	Rs.	Tons.	Rs.	Tons.	Rs.	
																	Loco	Non loco	

Proforma I (b)—Freight Charges Incurred—Question No. I (b)

Freight charges on supplies received from different fields.

[illegible]

APPENDIX NO. 1 (b) — (contd.)

Year	Division	Loco Shed	Quantity handled		loaded on tender		Total tons handled	Unloading	stacking	Handling charges.		Total Charges.	
			Unloaded	Stacked	Manually	Mechani- cally				Loading on Tender	Total		
													Manually	Mechani- cally.
1954-55													
1955-56													
1956-57													
I	2	3	4	5	6	7	8	9	10	11	12	13	14

Proforma 1 (d)—Incidental Costs—Question No. 1 (d)

	Sales Tax	Excise Duty & Cess	Demurrage	Ferry coal	Rail-borne coal trans-shipment charges	Sea-borne coal incident- al charges at loading ports and destination ports	Total
1	2	3	4	5	6	7	8

APPENDIX No. 2(b).—(contd.)

PROFORMA No. 2

QUESTION No. 3

Type of service	Sel. A		Sel. B		Grade I		Grade II		Ungraded	
	1954-55 1956-57	1955-56	1954-55 1956-57	1955-56	1954-55 1956-57	1955-56	1954-55 1956-57	1955-56	1954-55 1956-57	1955-56
1. Mail & Express										
2. Passenger & Parcel										
3. Suburban, Shuttle and local										
4. Total passenger										
5. Through goods										
6. Pick up & Van goods										
7. Total goods										
8. Mixed										
9. Shunting										
10. Departmental										

PROFORMA No. 3

QUESTION No. 4

Railway

Supplies (despatches) from different collieries.						
Year 1954-55 1955-56 1956-57	Name of colliery	Connecting colliery base station	Grade of Coal. Sel. A Sel. B Gr. I Gr. II Ungraded.	Quantity despatched (Tons)	Intake point on Railway.	Shed or sheds served.

APPENDIX No. 1(b)— (contd.)

PROFORMA No. 4

QUESTION No. 8

Total number of complaints lodged by railway to the Coal Controller regarding defective supplies of coal and number of complaints that were outstanding on 1-4-1955, 1-4-1956 & 1-4-1957.

Railway	1954-55						1955-56						1956-57			
	No. of complaints lodged to the Coal Controller	No. of wagons involved	No. of complaints outstanding.	No. of wagons involved.	No. of complaints lodged to the Coal Controller.	No. of wagons involved.	No. of complaints on which action was taken by Coal Controller.	No. of wagons involved.	No. of complaints on which action was taken by Coal Controller.	No. of complaints lodged to the Coal Controller.	No. of wagons involved.	No. of complaints outstanding.	No. of wagons involved.	No. of complaints on which action was taken by Coal Controller.	No. of wagons involved.	No. of complaints outstanding.

Quantities and costs of handling of coal in sheds.

PROFORMA No. 6
QUESTION No. 19

Individual Service.	Link (if any)	Type of Loco	Pooled or Non-pooled	Section worked	Trip mileage	*Nature of track,(a) or (b) or (c)	No. of stops in the section	Grade of coal.	Trip ratings fixed for the range of loads for grades of coal used. (Tons and Cwts.) Load—Load— Load——
					 नमो भगवते वासुदेवाय				

- (a) Level track represents operating conditions for starting trains on the level and running them on up gradients of 1 in 400.
- (b) Moderately graded track represents operating conditions for starting trains on 1 in 400 up gradients and running them on 1 in 200 up gradients.
- (c) Heavily graded track represents operating conditions for starting trains on 1 in 200 up gradients and running them on up gradients not exceeding 1 in 100.

PROFORMA No. 7
QUESTION NOS. 21, 22 & 23
Supplies of coal to Southern Railway

[illegible]

APPENDIX No. 1 (b) (contd.)

PROFORMA No. 8

QUESTION NOS. 24 & 25

Year	Receiving Division	Quantities supplied by rail route from outlying fields to the different divisions and the freight paid on them													
		C.I.C. (Madhya Pradesh)		Pench (Madhya Pradesh)		Chanda (Bombay)		Singareni (Andhra)		Talcher (Orissa)		Other fields, If any.		Total	
		Qty. Tons	Fr. Rs.	Qty. Tons	Fr. Rs.	Qty. Tons	Fr. Rs.	Qty. Tons	Fr. Rs.	Qty. Tons	Fr. Rs.	Qty. Tons	Fr. Rs.	Qty. Tons	Fr. Rs.
1954—55															
1955—56															
1956—57															

PROFORMA No. 9

QUESTION NOS. 26 & 27

Pilferage and Handling Losses on Sea—Borne Coal

Year 1955—56 1956—57	Losses on journey from colliery to receiving docks.				Losses on journey from receiving docks to sheds.				%age loss from colliery to receiving shed.	
	Receiv- ing Docks	Invoic- ed quantity	Quant- ity on ac- tual wei- ghment	Difference — losses on the journey	Receiv- ing shed	*invoic- ed quantity	Quant- ity on actual weigh- ment	Difference on the journey		
				Quant- ity				Quant- ity		
				%age of invoiced quantity				%age of invoiced quantity		

*Fresh invoice prepared on weightment at receiving docks.

PROFORMA No. 10

QUESTION NOS. 28 to 31

Statement showing unconnected and missing wagons

	Column I	Column II			Column III	Column IV	Column V	Column VI
Railways	No. of wagons consigned from colliery base station during the year only.	No. of wagons received in sheds during the year only.			Total unconnected wagons II (b) + II (c)	No. of wagons missing as at the end of the year Diff. of Col. I & II (a)	Wagons in Col. III traced upto 31-3-57	Number of wagons in Column IV traced upto 31-3-57
		Against those in Col. I	Wagons unconnected for lack of despatch particulars	Unconnected due to wagon interception or diversion.				
		II (a)	II (b)	II (c)				

APPENDIX No. 1(b) (contd.)

PROFORMA NO. II (Part A)

Question Nos. 36 & 37

Annual Expenditure on freight of Coal

1952-53			1953-54								
Quantity	Freight rate per ton	Total freight	Quantity	Freight rate per ton	Total freight	Increase in expen- diture over 1952-53 due to increase in quantity (at freight rates for 1952-53)	Percentage increase	Increase in expen- diture due to rise in freight rate	Percentage increase	Total increase	Total percentage increase

NOTE.—Information required separately for Loco and Non-loco. Data for 1954-55, 1955-56 and 1956-57 should be submitted as for 1953-54.

PROFORMA NO. II (Part B)

Question Nos. 36 & 37

Annual expenditure on coal at pit-head costs

1952-53				1953-54								
Grade of coal	Quantity received	Rate per ton	Pit head cost paid	Quantity received	Rate per ton	Total pit-head cost paid	Increase in expenditure over 1952-53 due to increase in quantity (at pit-head rates for 1952-53)	Percentage increase	Increase in expenditure due to rise in pit-head rate	Percentage increase	Total increase in expenditure	Total percentage increase

NOTE.—Information required separately for Loco and Non-loco. Data for 1954-55, 1955-56 and 1956-57 should be submitted as for 1953-54.

APPENDIX No. 1(b) (concl.)

PROFORMA NO. 12

Question No. 38

(Years 1954-55, 1955-56 & 1956-57)

Service Groups	Grade of coal assigned	Quantity demanded	Pit-head costs	Quantity actually consumed of								Excess quantity consumed due to inferior supply 8(a)-3	Cost of extra coal used 8(b)-4
				Correct grade		Nominally correct grade but found inferior on test	Nominally inferior grade		Total				
				Qty.	Pit-head cost		Qty.	P.H. cost	Qty.	P.H. cost	Qty.			P.H. cost
I	2	3 Tons	4 Rs.	5		6		7		8		9 Tons	10 Rs.
				(a) Tons	(b) Rs.	(a) Tons	(b) Rs.	(a) Tons	(b) Rs.	(a) Tons	(b) Rs.		
1. Mail & Express . . .													
2. Passenger . . .													
3. Local, shuttle and suburban . . .													
4. Total passenger . . .													
5. Through goods . . .													
6. Pick-up & Van goods . . .													
7. Total goods . . .													
8. Mixed . . .													
9. Shunting . . .													
10. Departmental . . .													

नमो भगवते वासुदेवाय

PROFORMA No. 13

Question No. 41

Statement showing number of Locomotives and their ages during 1952-53 and 1954-55 to 1956-57

Year	Type of Service	Number of locomotives				
		0 to 5 years	6 to 10 years	11 to 20 years	Over 20 years	Total
	Passenger					
	Goods					
	Shunting and Departmental					
	TOTAL					

APPENDIX No. 2

(Reference : Chapter II, Para 16)

Analysis showing the quantity of coal received, pit-head costs, freight charges paid thereon as well as a break-up of the increase in costs due to increase in quantity and due to rise in pit-head costs and freight rates.
(Quantity and value in thousands)

Particulars	Quantity (tons)			Pit-head costs				Freight			
	Total	Inc. (+) or dec. (—) over 1952-53	Percentage variation over 1952-53	Rate per ton (Rs.)	Total amount (Rs.)	Inc. (+) or dec. (—) over 1952-53	Percentage variation over 1952-53	Rate per ton (Rs.)	Total amount (Rs.)	Inc. (+) or dec. (—) over 1952-53	Percentage variation over 1952-53
I	2	3	4	5	6	7	8	9	10	11	12
LOCO:											
1952-53	10,162	..	..	15.50	15,74,85	..	..	13.25	13,46,92	..	..
1953-54	10,140	— 22	— 0.22	15.46	15,68,08	— 6,77	— 0.43	13.53	13,72,35	+25,43	+1.89
1954-55	10,533	+ 371	+ 3.65	15.63	16,46,12	+71 27	+4.52	14.44	15,20,56	+1,73,64	+12.89
1955-56	11,236	+1,974	+10.57	15.58	17,59,87	+1,76,02	+11.18	15.03	16,88,70	+3,41,78	+25.37
1956-57	12,174	+2,912	+19.80	17.81	21,68,75	+5,93,90	+37.71	15.37	18,70,76	+5,23,84	+38.89
NON-LOCO :											
1952-53	1,049	..	..	15.70	1,64,69	..	..	11.58	1,21,43	..	..
1953-54	1,130	+81	+7.72	15.81	1,78,66	+13,97	+8.48	11.67	1,31,91	+10,48	+8.63
1954-55	1,178	+129	+12.29	15.32	1,80,47	+15,78	+9.58	11.74	1,38,29	+16,86	+13.88
1955-56	1,131	+82	+7.81	15.66	1,77,99	+12 40	+7.52	12.33	1,39,47	+18,04	+14.85
1956-57	1,218	+169	+16.11	17.99	2,19,99	+54,40	+33.03	12.94	1,57,64	+36,21	+29.81
TOTAL :											
1952-53	11,211	..	..	15.52	17,39,54	..	..	13.10	14,68,35	..	..
1953-54	11,270	+59	+0.53	15.50	17,46,74	+7,20	+0.41	13.35	15,04,26	+35,91	+2.45
1954-55	11,711	+500	+4.45	15.60	18,26,59	+87,05	+5.00	14.16	16,58,85	+1,90,50	+12.97
1955-56	12,367	+1,156	+10.31	15.59	19,27,96	+1,88,42	+10.83	14.78	18,28,17	+3,59,82	+24.50
1956-57	13,392	+2,181	+19.45	17.83	23,87,84	+6,48,30	+37.26	15.15	20,28,40	+5,60,05	+38.14

APPENDIX No. 2. (concl.)

(Reference: Chapter II (para 16))

Analysis showing the quantity of coal received, pit-head costs freight charges paid thereon as well as a break-up of the increase in costs due to increase in quantity and due to rise in pit-head costs and freight rates

(Quantity and value in thousands)

Total costs (Pit-head & Freight)		Break-up of the increase in cost (col. 14) under:													
		(i) Excess quantity consumed					(ii) Rise in rate								
Particulars	Amount (Rs.)	Inc. (+) or dec. (-) over 1952-53	Per cent ge variation over 1952-53	(a) Pit-head at 1952-53 rates		(b) Freight at 1952-53 rates		(a) Pit-head		(b) Freight		% of Col. 14			
				Amount (Rs.)	% of col. 13 (1952-53)	% of Col. 14	Amount (Rs.)	% of col. 13 (1952-53)	% of Col. 14	Amount (Rs.)	% of col. 13 (1952-53)				
	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
LOCO :															
1952-53	29,21,77														
1953-54	29,40,43	+18,66	+0.64	-3.41	-0.12	-18.27	-2.92	-0.10	-15.65	-3.36	-0.11	-18.01	+28,35	+0.97	151.93
1954-55	31,66,68	+2,44,91	0.38	+57,50	+1.97	23.48	+49,17	+1.68	20.08	+13,77	+0.47	5.62	+1,24,47	+4.26	50.82
1955-56	34,39,57	+5,17,80	+17.72	+1,66,44	+5.70	32.14	+1,42,35	+4.87	7.49	+9,58	+0.32	1.85	+1,99,43	+6.83	38.52
1956-57	40,39,51	+11,17,74	+38.26	+3,11,81	+10.67	27.89	+2,66,68	+9.13	23.86	+2,82,09	+9.66	25.24	+2,57,16	+8.80	23.01
NON-LOCO															
1952-53	2,86,12														
1953-54	3,10,57	+24,45	+8.55	+12,72	+4.44	52.02	+9,38	+3.28	38.37	+1,25	+0.44	5.11	+1,10	+0.39	4.50
1954-55	3,18,76	+32,64	+11.40	+20,25	+7.07	62.04	+14,93	+5.22	45.74	-4,47	-1.56	-13.69	+1,93	+0.67	5.91
1955-56	3,16,56	+30,44	+10.63	+12,87	+4.50	42.28	+9,49	+3.31	31.17	-47	-0.17	-1.54	+8,55	+2.99	28.09
1956-57	5,56,73	+90,61	+31.66	+26,53	+9.27	29.28	+19,56	+6.81	21.59	+27,87	+9.74	30.76	+16,65	+5.81	18.37
TOTAL :															
1952-53	32,57,89														
1953-54	32,51,00	+43,11		+77,75	+0.29	21.60	+6,46	+0.20	14.98	-2,11	-0.07	-4.89	+29,45	+0.92	68.31
1954-55	34,85,44	+2,77,55	+8.65	+77,75	+2.42	28.01	+64,10	+2.00	23.10	+9,30	+0.29	3.35	+1,26,40	+3.94	45.54
1955-56	37,56,13	+5,48,24	+17.09	+1,79,31	+5.59	32.71	+1,51,84	+4.73	27.69	+9,11	+0.28	1.66	+2,07,98	+6.49	37.94
1956-57	44,16,24	+12,08,35	+37.66	+3,38,34	+10.54	28.00	+2,86,24	+8.92	23.69	+3,09,96	+9.66	25.65	+2,73,81	+8.54	22.66

APPENDIX No. 3

(Reference: Chapter II, para 16 and Chapter VI, para 50)

Statement showing quantities of Coal handled, handling costs incurred etc by Railways during the Years, 1954-55 to 1956-57

(Quantity and value in thousands)

Year	Railway	Quantity handled				Handling charges				Rate per Ton			
		Unloading		Stacking		Loading on Tender		Total	Unloading	Stacking	Loading on Tender		Total
		Tons	Tons	Tons	Tons	Manually	Mechanically				Rs.	Rs.	
1954-55 :	Central	2,199	365	1,865	292	7.96	47	20.40	1.05	29.88	0.36	1.10	0.36
	Eastern	1,367	1,133	93	1,777	1.95	45	92	4.22	7.54	0.14	0.31	0.24
	Northern	1,231	691	251	1,071	2.55	38	2.75	5.33	11.01	0.21	1.10	0.49
	N. Eastern	946	878	628	175	3.49	..	2.83	69	7.01	0.28	0.45	0.39
	S. Eastern	1,628	822	420	1,028	3.49	42	1.49	1.28	6.68	0.21	0.36	0.12
	Southern	1,461	1,264	1,217	234	4.82	48	8.80	1.26	15.36	0.33	0.04	0.42
	Western	1,429	1,429	668	791	5.82	*	6.77	6.31	18.90	0.41	1.00	0.79
	TOTAL	10,261	6,582	5,133	5,368	30.08	2.20	43.96	20.14	96.38	0.30	0.85	0.37
1955-56 :	Central	2,316	511	1,944	281	8.43	44	21.55	99	31.41	0.37	1.12	0.25
	Eastern	1,376	1,054	83	1,892	2.45	33	62	4.63	8.03	0.18	0.31	0.24
	Northern	1,518	636	406	1,181	3.74	39	3.75	5.48	13.36	0.25	0.61	0.46
	N. Eastern	987	849	683	194	3.60	..	2.84	95	7.39	0.36	0.41	0.49
	S. Eastern	1,637	830	436	1,046	3.35	39	1.33	1.24	6.31	0.20	0.30	0.12
	Southern	1,771	1,304	1,362	257	5.80	51	9.23	1.30	16.84	0.33	0.68	0.39
	Western	1,562	1,562	704	858	8.82	*	6.14	6.48	21.44	0.56	0.86	0.25
	TOTAL	11,167	6,746	5,618	5,709	36.19	2.06	45.46	21.07	1,04.78	0.32	0.81	0.36

* In the case of Western Railway, quantity unloaded is shown as stacked and no separate costs are shown under stacking. Costs of unloading include costs of stacking.

APPENDIX No. 3 (concl'd).
Statement showing quantities of Coal handled, handling costs incurred etc. by Railways during the Years 1954-55 to 1956-57
 (Quantity and value in thousands)

Year	Railway	Quantities handled				Handling charges						Rate per ton			
		Unloading	Stacking	Loading on tender		Unloading	Stacking	Loading tender		TOTAL	Unloading	Stacking	Loading on tender		
				Manually	Mechanically			Manually	Mechanically				Manually	Mechanically	
		Tons	Tons	Tons	Tons	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1956-57 :	Central	2,526	528	2,031	416	8,46	50	21,17	1,50	31,63	0.33	0.09	1.04	0.36	
	Eastern	1,522	1,153	74	2,037	3,61	37	67	5,42	10,07	0.24	0.32	0.91	0.27	
	Northern	1,691	627	457	1,333	5,32	31	4,15	5,60	15,38	0.31	0.50	0.91	0.42	
	N. Eastern	1,123	849	715	265	4,44	41	3,33	95	9,13	0.37	0.05	0.47	0.35	
	S. Eastern	1,777	895	449	1,122	5,60	47	1,45	1,34	8,86	0.32	0.05	0.30	0.12	
	Southern	1,710	1,483	1,562	230	6,50	57	9,44	1,35	17,86	0.38	0.03	0.63	0.47	
	Western	1,672	1,672	858	814	9,92	*	8,19	5,89	24,00	0.59	..	0.95	0.72	
	TOTAL	12,321	7,207	6,146	6,217	43,85	2,63	48,40	22,05	1,16,93	0.36	0.05	0.79	0.36	

*In the case of the Western Railway, quantity unloaded is shown as stabled and no separate costs are shown under stacking. Costs of unloading include costs of stacking.

APPENDIX No. 4

(Reference: Chapter II, Para 16)

Incidental costs on coal incurred by Railways during the years 1954-55 to 1956-57

(Figures in thousands of Rs.)

Railway	Sales Tax	Excise Duty and cess	Demmura-ge	Ferry coal	Rail-borne coal trans-shipment charges	Sea-borne coal incidental charges at loading ports and destination Ports	Total
1954—55 :							
Central . . .	241	1529	..	..	..	..	1770
Eastern . . .	593	1506	..	31	..	..	2130
Northern . . .	..	1329	6	..	115	..	1450
N. Eastern	59	571	..	..	228	..	858
S. Eastern . . .	240	1224	..	..	..	..	1464
Southern . . .	153	1179	..	..	150	6058	7540
Western . . .	..	1088	..	..	267	..	1355
TOTAL .	1286	8426	6	31	760	6058	16567
1955—56 :							
Central . . .	334	1671	..	..	..	..	2005
Eastern . . .	607	1444	..	34	..	..	2085
Northern . . .	..	1438	9	..	110	..	1557
N. Eastern . . .	71	550	..	..	236	..	857
S. Eastern . . .	264	1250	..	..	..	..	1514
Southern . . .	91	1435	..	..	161	6239	7926
Western . . .	..	1188	..	..	279	..	1467
TOTAL .	1367	8976	9	34	786	6239	17411
1956—57 :							
Central . . .	342	1772	..	..	..	..	2114
Eastern . . .	629	1459	..	27	..	..	2115
Northern . . .	..	1549	16	..	133	..	1698
N. Eastern . . .	204	549	..	..	367	..	1120
S. Eastern . . .	230	1386	..	..	..	..	1616
Southern . . .	80	1393	..	..	156	5286	6915
Western . . .	..	1272	..	..	305	..	1577
TOTAL .	1485	9380	16	27	961	5286	17155

APPENDIX No. 5

(Reference : Chapter No. III Para 2)

Number of collieries which supplied coal to individual Railways during 1954-55 to 1956-57, and the quantities supplied gradewise

(Quantities in thousands of tons)

Railway	Year	Sel. A		Sel. B		Gr. I.		Gr. II		Ungraded		Total	
		No. of Collieries	Quantity (Tons)	No. of Collieries	Quantity (Tons)	No. of Collieries	Quantity (Tons)	No. of Collieries	Quantity (Tons)	No. of Collieries	Quantity (Tons)	No. of Collieries	Quantity (Tons)
Central	1954-55	25	215	65	656	43	277	30	82	38	1442	198	2,672
	1955-56	32	219	71	679	61	365	21	31	32	1416	191	2,710
	1956-57	41	248	79	491	73	547	30	90	34	1633	234	3,009
Eastern	1954-55	24	127	67	419	95	965	49	255	..	..	218	790
	1955-56	53	178	109	501	144	960	111	233	..	..	324	1,872
	1956-57	83	238	152	595	178	608	185	322	..	..	435	1,763
Northern	1954-55	39	266	235	487	43	628	101	253	..	..	232	1,634
	1955-56	29	271	39	471	41	756	51	216	..	..	141	1,714
	1956-57	26	248	40	578	51	1,016	58	201	1	1	146	2,044
North Eastern	1954-55	21	112	77	202	89	291	61	100	3	203	235	908
	1955-56	41	83	91	351	76	211	90	94	24	184	182	922
	1956-57	29	66	110	455	125	378	70	91	11	164	256	1,154
South Eastern	1954-55	14	138	23	405	12	435	22	112	13	538	76	1,628
	1955-56	12	132	22	370	14	514	20	97	23	548	82	1,661
	1956-57	15	139	19	340	18	603	20	101	18	608	81	1,791
Western	1954-55	22	66	49	323	24	252	56	143	20	654	140	1,438
	1955-56	17	92	58	340	42	426	35	109	18	618	141	1,585
	1956-57	7	1	48	460	55	674	24	35	10	550	124	1,720
Southern	1954-55												
	{ by Rail	*	14	*	50	*	8	*	..	*	576	*	648
	{ by Sea		237		432		222		..		..		891
	1955-56												
	{ by Rail		74		199		69		..		604		946
	{ by Sea		320		386		223		..		..		929
	1956-57												
	{ by Rail		36		192		147		..	..	648		1,023
	{ by Sea		245		453		99		..		..		797

*Figures not furnished by the Railway.

APPENDIX No. 6

(Reference : Chapter III, Para 20)

The Maximum Number of Collieries that supplied Coal to Major Sheds during any one month and the monthly Average for the year 1956-57

Major sheds	Maximum No. of collieries supplying coal in any one month	Minimum No. of collieries supplying coal in any one month	Monthly average No. of collieries supplying coal during the year
1	2	3	4
CENTRAL RAILWAY			
Kalyan P. H. . . .	71	59	64
Dhond	30	18	24
Shahabad	28	9	20
Sholapur	24	16	20
Ajni	46	19	32
Wardha	26	7	16
Jabalpur	43	12	25
Satna	26	2	11
Bhusawal	67	33	51
Itarsi	56	25	38
Igatpuri	43	18	26
Murtizapur	34	12	25
Nandagaon	36	15	25
Jhansi	48	11	32
Mathura	28	11	18
Agra Cante. . . .	31	13	22
EASTERN RAILWAY			
Howrah Loco Depot . .	73	18	30
Burdwan	41	11	2
Bandel Jn. . . .	58	9	31
Sahibganj	56	12	31
Asansol	73	16	45
Gomoh	42	16	27
Jhajha	56	18	35
Dinapore	66	13	30
Gaya	69	21	47
Moghalsarai	104	28	60
NORTHERN RAILWAY			
Barcilly	43	21	34
Moradabad	83	50	64
Allahabad	58	27	40

APPENDIX No. 6 (Contd.)
(Reference: Chapter III, Para 20)

The Maximum and Minimum number of Collieries that supplied Coal to Major Sheds during any one month and the monthly Average for the year 1956-57

Major sheds	Maximum No. of collieries supplying coal in any one month	Minimum No. of collieries supplying coal in any one month	Monthly average No. of collieries supplying coal during the year
I	2	3	4
NORTHERN RAILWAY—Contd			
Kanpur	75	44	59
Tundla	58	35	51
Lucknow	90	33	51
Partapgarh	34	23	30
Jodhpur	63	37	50
Merta Road	38	7	27
Ambala Cantt	62	31	43
Saharanpur	57	24	42
Ludhiana	65	31	54
Amritsar	61	28	49
Ghaziabad	33	5	17
WESTERN RAILWAY			
Bulsar	32	7	15
Baroda	42	30	36
Godhur	41	22	32
Gangapur	34	24	31
Kotah	39	20	28
Kankaria	42	25	32
Ratlam	41	26	35
Shamgarh	42	23	28
Viramgam	26	14	20
Abu Road	33	10	25
Ajmer	35	23	27
Bandikui	28	8	23
Mehsana	30	2	20
Sabarmati	34	15	24
Sojat Road	33	15	23
SOUTH EASTERN RAILWAY			
Kharagpur	40	17	24
Santragachi	33	14	21
Chakardharpur	27	17	21

APPENDIX No. 6 (Concl'd.)

(Reference : Chapter III, Para 20)

The Maximum and Minimum Number of Collieries that supplied Coal to Major Sheds during any one month and the monthly Average for the year 1956-57

Major sheds	Maximum No. of collieries supplying coal in any one month	Minimum No. of collieries supplying coal in any one month	Monthly average No. of collieries supplying coal during the year
1	2	3	4
SOUTH EASTERN RAILWAY— <i>Contd.</i>			
Pata	25	13	18
Jharsuguda	19	7	11
Bilaspur	15	7	10
Dongargarh	16	6	9
Adra	20	8	12
Bhojudih	17	8	13
Waltair	29	4	14
Khurda Road	19	9	14
Kantabanji	15	5	10
NORTH EASTERN RAILWAY			
Alipurduar Jn.	34	15	24
Banaras Cantt.	53	24	33
Bareilly Jn.	29	13	20
Lucknow	35	13	25
Mokamehghat	72	25	49
Siliguri Jn.	44	18	29
Sitapur	54	3	21
Kanpur	13	4	8
Katihar	27	3	14

APPENDIX No. 7 (a)
(Reference : Chapter III, Para 22)

TABLE A
Rapid quality survey in September 1957
BENGAL & BIHAR FIELDS

Selected 'A'

Railway	Total No. of checks carried out	Correct grade	One grade lower	Two grades lower	More than 2 grades lower	Average supplies per month (Tons)
Central	13	3	3	2	5	34,734
Northern	18	13	2	2	1	26,253
Eastern	9	5	3	1	..	14,007
Southern	4	..	2	..	2	18,931
Western	1	..	..	..	1	308
North-Eastern	6	1	3	1	1	11,279
South-Eastern	15	3	4	4	4	9,581
TOTAL	66	25	17	10	14	115,093

One sample for every 500 tons received in major sheds where samples were drawn.

One sample for every 1744 tons on the basis of whole Railway.

	Percentage
Correct grade	37.90
One grade lower	25.75
Two grades lower	15.15
More than 2 grades lower	21.20

APPENDIX No. 7(a) (Contd.)
(Reference : Chapter III, Para 22)

TABLE B

Rapid quality survey in September 1957
BENGAL AND BIHAR FIELDS

Selected 'B'

Railway	Total No. of checks carried out	Correct grade	One grade lower	Two grades lower	More than two grades lower	Average supplies per month (Tons)
Central	21	3	10	4	4	29,957
Northern	20	6	5	4	5	48,004
Eastern	22	11	4	7	..	45,551
Southern	31	1	18	11	1	53,390
Western	25	11	6	5	3	53,093
North-Eastern	15	7	5	1	2	42,482
South-Eastern	26	12	4	6	4	28,985
TOTAL	160	*51	52	38	19	301,462

One sample for every 500 tons received in major sheds where samples were drawn.

One sample for every 1884 tons on the basis of whole Railway.

*Out of these 22 were better than the correct grade.

	Percentage
Correct grade	31.90
One grade lower	32.50
Two grades lower	23.73
More than two grades lower	11.87

APPENDIX No. 7(a) (Contd.)

(Reference : Chapter III, Para 22)

TABLE C

Rapid quality survey in September 1957
BENGAL AND BIHAR FIELDS

Grade I

Railway	Total No. of checks carried out	Correct grade	One grade lower	Two grades lower	More than two grades lower	Average supplies per month (Tons)
Central	22	5	6	11	..	55,399
Northern	71	35	22	13	1	83,659
Eastern	35	14	12	9	..	89,324
Southern	7	3	3	1	..	43,179
Western	24	12	7	5	..	59,877
North-Eastern	14	5	5	3	1	33,462
South-Eastern	34	18	12	4	..	50,299
TOTAL	207	*92	67	46	2	415,199

One sample for every 500 tons of coal received in major sheds where samples were drawn.

One sample for every 2005 tons on the basis of whole Railway.

*Out of these 39 were better than the correct grade.

	Percentage
Correct grade	44.42
One grade lower	32.39
Two grades lower	22.22
More than two grades lower	0.97

APPENDIX 7 (a)—(Contd.)
(Reference: Chapter III, Para 22).

TABLE D

Rapid quality survey in September, 1957

BENGAL AND BIHAR FIELDS

Grade II

Railway	Total No. of checks carried out	Correct grade	One grade lower	Two grades lower (Unvendi- ble)	Average supplies per month (Tons)
Central	4	1	3	..	1,918
Northern	5	2	3	..	13,900
Eastern	13	11	2	..	28,772
Southern . . . . .	..	..	..	..	..
Western . . . . .	..	..	..	..	..
North-Eastern	2	1	..	1	3,890
South-Eastern	6	3	3	..	7,784
TOTAL	30	*18	11	1	56,264

One sample for every 500 tons of coal received in major sheds where samples were drawn.

One sample for every 1875 tons on the basis of whole Railway.

*Out of these, 9 were better than the correct grade.

	Percentage
Correct grade	60.00
One grade lower	36.67
Two grades lower (Unvendible)	3.33

APPENDIX No. 7(a)—(Contd.)

(Reference: Chapter III, Para 22)

TABLE E

Rapid quality survey in September, 1957

BENGAL & BIHAR FIELDS

Railway	Quantity of specified grade actually consumed during April, '57 to Sep. '57 (in thousands of tons)	Percentage excess consumption due to supply not conforming to grade	Quantity required if the supply had been to specified grade (in thousands of tons)	Cost of quantity in col. (4) (Pithead plus freight) (Rs. in lakhs)	Quantity excess consumed (in thousands of tons)	Pithead cost of excess quantity consumed. (Rs. in lakhs)	Freight on excess quantity consumed (Rs. in lakhs)	Total extra expenditure (Col. 7 plus Col. 8) (Rs. in lakhs)	Percentage of Col. 9 to Col. 5
1	2	3	4	5	6	7	8	9	10
Central	732	18.15	620	246.3	112.5	22.3	22.4	44.7	18.1
Northern	1,031	10.35	934	357.5	96.6	18.9	18.1	37.0	10.3
Eastern	1,066	7.18	995	272.6	70.9	13.8	5.8	19.6	7.2
Southern	693	11.97	619	392.0	73.9	14.7	32.2	46.9	12.0
Western	680	9.14	623	276.7	57.0	11.2	14.2	25.4	9.1
North-Eastern	546	13.45	481	171.9	65.4	12.7	10.4	23.1	13.4
South-Eastern	580	7.82	538	148.6	41.7	8.2	3.4	11.6	7.8
TOTAL	5,328	10.7	4,810	1865.6	518.0	101.8	106.5	208.3	11.2

Estimated extra expenditure annually $2 \times$ Col. 9 = Rs. 4.16 lakhs.

NOTE.—The above table includes coal consumption on non-loco boilers which is roughly 10% of the total consumption. Thermal efficiency in non-loco boilers is somewhat higher and this will cause a difference in increased consumption of coal by about 0.7% which is insignificant.

APPENDIX No. 7(a) (contd.)
(Reference: Chapter III, Para 22)
CENTRAL RAILWAY
Rapid quality survey in September, 1957
DETAILS OF ANALYSIS
BENGAL AND BIHAR FIELDS

(Statement 1)

	No. of samples analysed	No. of samples conforming with						Average increased consumption as against 100 tons of specified Grade
		Sel. A	Sel. B	Gr. I	Gr. II	Gr. III(A) & III(B)	Unvendible	
Specified Grade Sel. A Increase in consumption over specified grade.	13	3	3 ³ 94%	11 ² 28%	..	42 ⁵ 67%	..	$\left\{ \begin{array}{l} (3 \times 100 + 10 \times 103.94) \div 13 \\ 111.28 + 5 \\ 119.06 \end{array} \right.$
Specified Grade Sel. B Increase in consumption over specified Grade.	21	..	3 ¹⁰ 7 33%	21 ⁴ 5%	38 ⁴ 72%	..	..	$\left\{ \begin{array}{l} (3 \times 100 + 10 \times 107.33) \div 21 \\ 121.5 + 4 \\ 114.96 \end{array} \right.$
Specified Grade, Gr. I Increase in consumption over specified grade.	22	..	..	5 ⁶ 14 17%	31 ¹¹ 39%	..	..	$\left\{ \begin{array}{l} (5 \times 100 + 5 \times 114.7) \div 22 \\ 131.39 \end{array} \right. \div 22 = 19.56$
Specified Grade, Gr. II Increase in consumption over specified Grade.	4	..	..	..	1 ³ 17 22%	..	..	$\left\{ \begin{array}{l} (1 \times 100 + 3 \times 117.22) \div 4 \\ 112.92 \end{array} \right.$

NOTE : Relative percentage increases in coal consumption due to fall in grade are derived from Graph V, Chapter III.

ADDITIONAL EXPENDITURE (6 MONTHS) BASED ON RAPID QUALITY SURVEY IN SEPTEMBER, 1957

Specified Grade	Quality of specified grade actually consumed (April 57 to September 57) (tons)	Percentage Excess consumption due to supply not conforming to the specified Grade (%)	Quantity required if the supply had been to the specified Gr. Col. (2) $\times 100 \div [100 + \text{Col. (3)}]$ (tons)	Cost of quantity in Col. (4) (Pithead cost + Av. Freight) (Rs.)	Quantity excess consumed Cols. (2) - (4) (tons)	Pithead cost of excess quantity consumed (Rs.)	Freight on quantity excess consumed (Rs.)	Total extra expenditure Col. (7) + (8) (Rs.)	Percentage of Col. 9 to Col. 5 (%)
I	2	3	4	5	6	7	8	9	10
Sel. A . . .	208,406	19.06	175,043	71,59,250	23,363	7,00,623	6,63,924	13,64,547	19.06
Sel. B . . .	179,740	14.96	156,350	62,38,360	23,390	4,67,800	4,65,461	9,33,261	14.96
Gr. I . . .	332,398	19.56	278,018	1,08,48,300	54,380	10,39,750	10,82,160	21,21,910	19.56
Gr. II . . .	11,506	12.92	10,190	3,86,183	1,316	23,688	26,188	49,876	12.92
TOTAL . . .	732,050	18.15	619,601	2,46,32,093	112,4	22,31,861	22,37,733	44,69,594	18.15

NOTE : Based on Average Pithead Prices, per ton.

Average Freight/ton

Sel. A. Rs. 21.00

Rs. 19.9

Sel. B. Rs. 20.00

Gr. I. Rs. 19.12

Gr. II Rs. 18.00

APPENDIX No. 7(a)—*contd.*
(Reference: Chapter III, Para 22)
EASTERN RAILWAY

Rapid Quality Survey in September, 1957

DETAILS OF ANALYSIS
BENGAL AND BIHAR FIELDS
(Statement II)

	No. of samples analysed	No. of samples conforming with						Average Increased consumption as against 100 tons of specific grade
		Sel. A	Sel. B	Gr. I	Gr. II	Gr. III-A and III-B	Unvendible	
Specified grade Sel. A	9	5	3	1	..	..	..	$\left\{ \begin{array}{l} (5 \times 100 + 3 \times 103.95 \\ + 1 \times 111.28) \\ \div 9 = 102.57 \end{array} \right.$
Increase in consumption over specified grade.		..	3.95%	11.28%				
Specified grade Sel. B	22	5	6	4	7	..	..	$\left\{ \begin{array}{l} (5 \times 96.05 + 6 \times 100 \\ + 4 \times 107.33 + 7 \times \\ 121.5) \div 22 = 107.28 \end{array} \right.$
Increase in consumption over specified grade		-3.95%	..	7.33%	21.5%	..	..
Specified grade, Gr. I	35	1	3	10	12	9	..	$\left\{ \begin{array}{l} (1 \times 88.72 + 3 \times 92.67 \\ + 10 \times 100 + 12 \\ \times 114.17 + 9 \times 131.39) \\ \div 35 = 111.98 \end{array} \right.$
Increase in consumption over specified grade	..	-11.28	-7.33%	..	14.17%	31.39%	..	
Specified grade, Gr. II	13	..	2	3	6	2	..	$\left\{ \begin{array}{l} (2 \times 78.5 + 3 \times 85.83 \\ + 6 \times 100 + 2 \times 117.22) \\ \div 13 = 96.07 \end{array} \right.$
Increase in consumption over specified grade	..		-21.5%	-14.17%	..	17.22%	..	

NOTE. Relative percentage increases in coal consumption due to fall in grade, are derived from Graph V Chapter III

Additional Expenditure (6 months) based on rapid quality survey in September, 1957.

Specified Grade	Quantity of specified grade actually consumed April '57 to September 1957)	Percentage excess consumption due to supply not conforming to specified grade	Quantity required if the supply had been to the specified grade col. (2) $\times 100 \div [100 \times \text{col. (3)}]$	Cost of quantity in col. 4 (Pit-head cost + Average freight)	Quantity excess consumed cols. (2)-(4)	Pithead cost of excess consumed	Freight on quantity excess consumed	Total extra expenditure cols. (7) + (8)	Percentage of col. (9) to col. (5)
	Tons	%	Tons	Rs.	Tons	Rs.	Rs.	Rs.	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	10
Sel. A . . .	84,040	2.57	81,934	23,84,290	2,106	44,226	17,059	61,285	2.57
Sel. B . . .	273,306	7.28	254,759	71,58,740	18,547	3,70,940	1,50,231	5,21,171	7.28
Grade I . . .	535,942	11.98	478,605	1,30,27,650	57,337	10,96,280	4,64,430	15,60,710	11.98
Grade II . . .	172,634	-3.93	179,696	46,90,070	-7,062	-1,27,116	-57,202	-1,84,318	-3.93
TOTAL	1,065,922	7.18	994,994	2,72,60,750	70,928	13,84,330	5,74,518	19,58,848	7.18

NOTE :—

Based on Average pit-head prices per ton.

Sel. A . . .	Rs. 21.00
Sel. B . . .	20.00
Grade I . . .	19.12
Grade II . . .	18.00

Average Freight/Ton

Rs. 8.10

APPENDIX No. 7(a) (Contd.)
(Reference: Chapter, III Para 22)
NORTHERN RAILWAY

Rapid Quality Survey in September, 1957.

DETAILS OF ANALYSIS

(STATEMENT III)

BENGAL AND BIHAR FIELDS

	No. of sample analysed	No. of samples conforming with				Gr. IIIA and IIIB	Un-vendible	Average increased consumption as against 100 tons of specified grade.
		Sel. A	Sel. B	Gr. I	Gr. II			
Specified grade Sel. A	18	13	2	2	1	..	..	$\left\{ \begin{array}{l} (13 \times 100 + 2 \times 103.95 \\ + 2 \times 111.28 + 1 \times 125.45) \div 18 \\ = 103.11 \end{array} \right.$
Increase in consumption over specified grade . . . . .	..	..	3.95%	11.28%	25.45%	..	..
Specified grade Sel. B	20	4	2	5	4	4	1	$\left\{ \begin{array}{l} (4 \times 96.05 + 2 \times 100 \\ + 5 \times 107.33 + 4 \times 121.5 + 4 \times 138.72 \\ + 1 \times 200) \div 20 = \\ 118.09 \end{array} \right.$
Increase in consumption over specified grade . . . . .	..	—3.95%	..	7.33%	21.5%	38.72%	100%	
Specified grade Gr. I	71	5	11	19	22	13	1	$\left\{ \begin{array}{l} (5 \times 88.72 + 11 \times 92.67 + 19 \times 100 + 22 \times 114.17 + 13 \times 131.39 + 1 \times 200) \div 2 \\ = 109.62 \end{array} \right.$
Increase in consumption over specified grade . . . . .	..	—11.28%	—7.33%	..	14.17%	31.39%	100%	
Specified grade Gr. II	5	..	..	2	..	3	..	$\left\{ \begin{array}{l} (2 \times 85.83 + 3 \times 117.22) \div 5 \\ = 104.66 \end{array} \right.$
Increase in consumption over specified grade . . . . .	..	..	..	—14.17%	..	17.22%	..	

NOTE.—Relative percentage increases in coal consumption due to fall in grade are derived from Graph V, Chapter III

Additional Expenditure (6 months) based on rapid quality survey in September 1957.

Specified Grade	Quantity of specified grade actually consumed (April '57 to September '57) (Tons)	Percentage excess consumption due to supply not conforming to the specified grade (%)	Quantity reqd. if the supply had been to the specified grade (Col. (2) $\times 100 \div (100 + \text{Col. 3})$ (Tons)	Cost of quantity in Col. (4) (Pit-head cost + Average freight) (Rs.)	Quantity excess consumed col. (2) — (4). (Rs.)	Pithead cost of excess quantity consumed (Tons)	Freight on excess quantity consumed (Rs.)	Total extra expenditure col. (7) + (8). (Rs.)	Percentage of Col. 9 to Col. 5
I	2	3	4	5	6	7	8	9	10
Sel. A	157,520	3.11	152,769	60,64,925	4,751	99,771	88,844	1,88,615	3.11
Sel. B.	288,024	18.09	243,902	94,39,010	44,122	8,82,440	8,25,081	17,07,521	18.09
Grade I	501,952	9.62	457,902	1,73,17,850	44,050	8,42,236	8,23,735	16,65,971	9.62
Grade II	83,402	4.66	79,689	29,24,570	3,713	66,834	69,433	1,36,267	4.66
TOTAL.	1,030,898	10.35	934,262	3,57,46,355	96,636	18,91,281	18,07,093	36,98,374	10.35

NOTE:—

Based on
Average
Pithead
prices per
ton

Average
Freight/Ton

Sel. A	Rs. 21.00	}	Rs. 18.70
Sel. B.	20.00		
Grade I	19.12		
Grade II	18.00		

Appendix No. 7(a)—(Contd.)
(Reference: Chapter III, Para. 22)

NORTH EASTERN RAILWAY

Rapid Quality Survey in September, 1957

DETAILS OF ANALYSIS

(STATEMENT IV)

BENGAL AND BIHAR FIELDS

	No. of samples analysed	No. of samples conforming with						Average increased consumption as against 100 tons of specified grade
		Sel. A	Sel. B	Gr. I	Gr. II	Gr. III-A and III-B	Un-vendible	
Specified grade Sel. A	6	1	3	1	1	..	..	$(1 \times 100 + 3 \times 103.95 + 1 \times 111.28 + 1 \times 125.45) \div 6 = 108.1$
Increase in consumption over specified grade.		..	3.95%	11.28%	25.45%			
Specified grade Sel. B	15	1	6	5	1	2	..	$(1 \times 96.05 + 6 \times 100 + 5 \times 107.33 + 1 \times 121.5 + 2 \times 138.72) \div 15 = 108.78$
Increase in consumption over specified grade.		-3.95%	..	7.33%	21.5%	38.72%	..	
Specified grade Gr. I	14	..	..	5	5	3		$(5 \times 100 + 5 \times 114.17 + 3 \times 131.39 + 1 \times 200) \div 14 = 118.93$
Increase in consumption over specified grade.		..	..	..	14.17%	31.39%	100%	
Specified grade Gr. II	2	..	..	..	1	..	1	$(1 \times 100 + 1 \times 200) \div 2 = 150$
Increase in consumption over specified grade				..	..	..	100%	

NOTE :—Relative percentage increases in coal consumption due to fall in grade, are derived from Graph V, Chapter—III.

Additional Expenditure (6 months) based on Rapid Quality Survey of September 1957.

Specified grade	Quantity of specified grade actually consumed April '57 to September 1957	percentage excess consumption due to supply not conforming to specified grade	Quantity required if the supply had been to the specified grade Col. (2) $\times 100 \div (100 - \text{Col. 3})$	Cost of quantity in Col. 4 Pithead cost - Av. freight	Quantity excess consumed Col. (2) - Col. (4)	Pithead cost of excess quantity consumed	Freight on quantity excess consumed	Total extra expenditure col. (7) + (8)	Percentage of Col. (9) to Col. (5)
	Tons	%	Tons	Rs.	Tons	Rs.	Rs.	Rs.	%
1	2	3	4	5	6	7	8	9	10
Sel. A	67,672	8.1	62,601	2,313,120	5,071	106,491	80,882	1,87,373	8.1
Sel. B	254,892	8.78	234,319	84,23,760	20,573	411,460	3,28,140	7,39,600	8.78
Grade I	200,772	18.93	168,815	5920,350	31,957	611,018	5,09,714	11,20,732	18.93
Grade II	23,342	50.0	15,561	528,307	7,781	140,053	1,24,105	2,64,163	50.00
TOTAL	546,678	13.45	481,296	17,185,537	65,382	1,269,027	10,42,841	23,11,868	13.45

NOTE :—

	Based on Average pithead prices per ton	Average freight/ton
	Rs.	Rs.
Sel. A	21.00	15.95
Sel. B	20.00	
Grade I.	19.12	
Grade II	18.00	

APPENDIX No. 7 (a) (contd.)
(Reference: Chapter III, Para 22)
SOUTH-EASTERN RAILWAY

Rapid Quality Survey in September 1957

DETAILS OF ANALYSIS

(Statement V)

BENGAL AND BIHAR FIELDS

	No. of samples analysed	No. of samples conforming with						Average increase consumption as against 100 ton of specified grade
		Sel. A	Sel. B	Gr. I	Gr. II	Gr. IIIA & IIIB	Unvendible	
Specified grade Sel. A .	15	3	4	4	4	..	..	$\left\{ \begin{array}{l} (3 \times 100 + 4 \times 103.95 \\ + 4 \times 111.28 \\ + 4 \times 125.45) \div \\ 15 = 110.85 \end{array} \right.$
Increase in consumption over specified grade.		..	3.95%	11.28%	25.45%	..	..
Specified grade Sel. B .	26	7	5	4	6	4	..	$\left\{ \begin{array}{l} (7 \times 96.05 + 5 \times \\ 100 + 4 \times 107.33 \\ + 6 \times 121.5 + \\ 4 \times 138.72) \div \\ 26 = 110.98 \end{array} \right.$
Increase in consumption over specified grade .		-3.95%	..	7.33%	21.5%	38.72%	..	
Specified grade Gr I .	34	5	6	7	12	4	..	$\left\{ \begin{array}{l} (5 \times 88.72 + 6 \times \\ 92.67 + 7 \times 100 \\ + 12 \times 114.17 + \\ 4 \times 131.39) \div \\ 34 = 106.03 \end{array} \right.$
Increase in consumption over specified grade.		-11.28%	-7.33%	..	14.17%	31.39%	..	
Specified grade Gr II .	6	..	..	2	1	3	..	$\left\{ \begin{array}{l} (2 \times 85.83 + \\ 1 \times 100 + 3 \\ \times 117.22) \div \\ 6 = 103.88 \end{array} \right.$
Increase in consumption over specified grade.		..	..	-14.17%	..	17.22%	..	

NOTE.—Relative percentage increases in coal consumption due to fall in grade are derived from Graph V, Chapter III.

ADDITIONAL EXPENDITURE (6 MONTHS) BASED ON RAPID QUALITY SURVEY IN SEPTEMBER 1957

Specified grade	Quantity of specified grade actually consumed (April 57 to Sep. 57)	Percentage excess consumption due to supply not conforming to specified grade	Quantity required if the supply had been to the specified grade	Cost of quantity in Col. 4 Pit-head cost + Average freight	Quantity excess consumed Cols. (2) — (4)	Pit-head cost of excess quantity consumed	Freight on quantity excess consumed	Total extra expenditure Cols. (7) + (8)	Percentage of Col. (9) to Col. (5)
	(Tons)	(%)	(Tons)	(Rs.)	(Tons)	(Rs.)	(Rs.)	(Rs.)	(%)
I	2	3	4	5	6	7	8	9	10
Sel. A	57,486	10.85	51,859	15,11,700	5,627	1,18,167	45,860	1,64,027	10.85
Sel. B	173,910	10.98	156,704	44,11,216	17,206	3,44,120	140,229	4,84,349	10.98
Gr. I	301,796	6.03	284,633	77,61,930	17,163	3,28,156	139,880	4,68,036	6.03
Gr. II	46,706	3.88	44,962	11,75,745	1,744	31,392	14,246	45,638	3.88
TOTAL	579,898	7.82	538,158	148,60,591	41,740	8,21,835	340,215	11,62,050	7.82

NOTE.— Based on average pithead prices Rs./Ton Average freight ton Rs.

Sel. A	21.00	8.15
Sel. B	20.00	
Gr. I	19.12	
Gr. II	18.00	

APPENDIX No. 7—contd.
(Reference : Chapter III, Para 22)
SOUTHERN RAILWAY
Rapid Quality Survey in September 1957
DETAILS OF ANALYSIS

(Statement VI)

BENGAL AND BIHAR FIELDS

	No. of samples analysed	No. of samples conforming with						Average increased consumption as against 100 tons of specified grade.
		Sel. A	Sel. B	Gr. I	Gr. II	Gr. III-A and III-B	Unvendible	
Specified grade Sel. A .	4	..	2	..	2	..	..	$\left\{ \begin{array}{l} (2 \times 103.95 + 2 \\ \times 125.45) \div \\ 4 = 114.7. \end{array} \right.$
Increase in consumption over specified grade	..	..	3.95%	..	25.45%	..	..
Specified grade Sel. B .	31	1	..	18	11	1	..	$\left\{ \begin{array}{l} (1 \times 96.05 + \\ 18 \times 107.33 + \\ 11 \times 121.5 + 1 \\ \times 138.72) \div \\ 31 = 113.01 \end{array} \right.$
Increase in consumption over specified grade.	..	—3.95%	..	7.33%	21.5%	38.72%	..	
Specified grade Gr. I .	7	..	1	2	3	1	..	$\left\{ \begin{array}{l} (1 \times 92.67 + 2 \times \\ 100 + 3 \times 114.1 \\ + 1 \times 131.39) \\ \div 7 = 109.51 \end{array} \right.$
Increase in consumption over specified grade.	..	..	—7.33%	..	14.17%	31.39%	..	
Specified grade Gr. II	Nil.	..	..	..	..	..	..

NOTE : Relative percentage increases in coal consumption due to fall in grade are derived from Graph V Chapter III.

ADDITIONAL EXPENDITURE (6 MONTHS) BASED ON RAPID QUALITY SURVEY IN
SEPTEMBER, 1957

Specified grade	Quantity of specified grade actually consumed (April 57 to Sep., 57)	Percentage excess consumption due to supply not conforming to the specified grade (%)	Quantity required if the supply had been to the specified grade Col. 2 × 100 ÷ (100 + % Col. 3)	Cost of quantity in col. 4 (Pit-head cost + Average freight)	Quantity excess consumed Col. (2) - (4)	Pit-head cost of excess quantity consumed	Freight on quantity excess consumed	Total extra expenditure Cols. (7) & (8)	Percentage of Col. 9 to Col. 5
I	(Tons) 2	(%) 3	(Tons) 4	(Rs.) 5	(Tons.) 6	(Rs.) 7	(Rs.) 8	(Rs.) 9	(%) 10
Sel. A	113,586	14.70	99,029	63,87,360	14,557	3,05,697	6,33,230	9,38,927	14.7
Sel. B	320,342	13.01	283,463	1,80,00,000	36,879	7,37,580	16,04,240	23,41,820	13.01
Gr. I	259,072	9.51	236,574	1,48,14,250	22,498	4,30,162	9,78,663	14,08,825	9.51
Gr. I	Nil	..	..	..	..	..	..	..	..
TOTAL	693,000	11.97	619,066	3,92,01,610	73,934	14,73,439	32,16,133	46,89,572	11.9

NOTE :

Based on
Average pit-head prices
(per ton)

Average freight/ton

Rs.

Rs.

Sel. A 21.00

43.50

Sel. B 20.00

Gr. I 19.12

Gr. II 18.00

APPENDIX No. 7(A)—(Concl'd.)

(Reference : Chapter III, Para 22)

WESTERN RAILWAY

Rapid quality survey in September, 1957

DETAILS OF ANALYSIS

(Statement VII)

BENGAL AND BIHAR FIELDS

	No. of samples analysed	No. of samples conforming with						Average increased consumption as against 100 tons of specified Grade
		Sel. A	Sel. B	Gr. I	Gr. II	Gr. IIIA & III 'B'	Unvendible	
Specified Grade Sel. A.	1	..	..	..	..	1	..	$(1 \times 142.67) \div 1$ $= 142.67$
Increase in consumption over specified Grade.	..	..	..	..	..	42.67%	..	
Specified grade Sel. B	25	4	7	6	5	3	..	$(4 \times 96.05 + 7 \times 100 + 6 \times 107.33 + 5 \times 121.5 + 3 \times 138.72) \div 25$ $= 110.07$
Increase in consumption over specified grade.	..	-3.95%	..	7.33%	21.5%	38.72%	..	
Specified Grade Gr. I	24	2	5	5	7	5	..	$(2 \times 88.72 + 5 \times 100 + 7 \times 114.17 + 5 \times 131.3) \div 24 = 108.21$
Increase in consumption over specified grade	..	-11.28%	-7.33	..	14.17%	31.39%	..	
Specified Grade Gr. II	Nil	..	..	..	..	..	..

NOTE.—Relative percentage increases in coal consumption due to fall in grade are derived from Graph V, Chapter III.

ADDITIONAL EXPENDITURE (6 MONTHS) BASED ON RAPID QUALITY SURVEY IN SEPTEMBER 1957

I	2	3	4	5	6	7	8	9	10
Specified Grade	Quantity of specified grade actually consumed (April '57 to Sep. '57)	Percentage excess consumption due to supply not conforming to the specified Grade	Quantity required if the supply had been to the specified Gr. Col. (2) $\times 100 \div [100 + \text{Col. (3)}]$	Cost of quantity in Col. (4) (Pit-head cost + Av. Freight)	Quantity Excess consumed Cols. (2) — (4)	Pit-head cost of excess quantity consumed	Freight on quantity excess consumed	Total extra expenditure Col. (7) + (8)	Percentage of Col. 9 to Col. 5
	Tons	%	Tons	Rs.	Tons	Rs.	Rs.	Rs.	%
I	2	3	4	5	6	7	8	9	10
Sel. 'A'	1,848	42.67	1,295	59,454	553	11,613	13,770	25,383	42.67
Sel. 'B'	318,560	10.07	289,416	1,29,94,760	29,144	5,82,880	7,25,686	13,08,566	10.07
Grade I	359,260	8.21	332,003	1,46,14,760	27,257	5,21,154	6,78,699	11,99,853	8.21
Grade II	..	..	..	..	..	..	..	..	..
TOTAL	679,668	9.14	622,714	2,76,68,974	56,954	11,15,647	14,18,155	25,33,802	9.14

NOTE.—Based on Average pit-head Prices per ton

Average Freight/Ton

	Rs.	Rs.
Sel. A	21.00	24.90
Sel. B	20.00	
Gr. I	19.12	
Gr. II	18.00	

APPENDIX No. 7(b)

(Reference : Chapter III, Para 23)

TABLE 'A'

Rapid quality survey in January, 1958

BENGAL & BIHAR FIELDS

Selected 'A'

Railway	Total No. of checks carried out	Correct grade	One grade lower	Two grades lower	More than two grades lower	Average supplies per month (Tons)
Central	23	3	5	9	6	34,734
Northern	8	6	1	1	..	26,253
Eastern	8	5	..	2	1	14,007
Southern	5	..	1	3	1	18,931
Western . . . . .	..	..	..	..	..	..
North Eastern	8	7	..	..	1	11,279
South Eastern	14	11	1	2	..	9,581
TOTAL	66	32	8	17	9	114,785

One sample for every 500 tons of coal received in major sheds where samples were drawn.

One sample for every 1739 tons on the basis of whole railway.

	Percentage
Correct grade	48.48
One grade lower	12.12
Two grades lower	25.76
More than two grades lower	13.64

APPENDIX No. 7(b).—(contd.)

(Reference : Chapter III, Para 23)

TABLE B

Rapid quality survey in January, 1958

Selected 'B'

BENGAL & BIHAR FIELDS

Railway	Total No. of checks carried out	Correct grade	One grade lower	Two grades lower	More than two grades lower	Average supplies per month (Tons)
Central	36	5	10	19	2	29,957
Northern	30	16	6	1	7	48,004
Eastern	20	7	8	3	2	45,551
Southern	31	8	20	3	..	53,390
Western	22	7	..	9	6	53,093
North Eastern	14	7	2	2	3	42,482
South Eastern	31	18	7	5	1	28,985
TOTAL	184	*68	53	42	21	301,462

One sample for every 500 tons of coal received in major sheds where samples were drawn.

One sample for every 1638 tons on the basis of whole Railway.

*Out of these 28 were better than the correct grade.

Percentage

Correct grade	36.95
One grade lower	28.82
Two grades lower	22.82
More than two grades lower	11.41

TABLE C

Rapid quality survey in January, 1958

BENGAL AND BIHAR FIELDS

Grade I

Railway	Total No. of checks carried out	Correct grade	One grade lower	Two grades lower	More than two grades lower	Average supplies per month. (Tons)
Central	18	6	4	8	..	55,399
Northern	42	25	7	9	1	83,659
Eastern	46	23	12	11	..	89,324
Southern	8	5	2	1	..	43,179
Western	23	4	4	15	..	59,877
North Eastern	8	3	3	2	..	33,462
South Eastern	43	27	12	2	2	50,299
TOTAL	188	*93	44	48	3	415,199

One sample for every 500 tons of coal received in major sheds where samples were drawn.

One sample for every 2208 tons on the basis of whole Railway.

*Out of these, 51 were better than the correct grade.

	Percentage
Correct grade	49.47
One grade lower	23.41
Two grades lower	25.52
More than two grades lower	1.60

APPENDIX No. 7(b).—(contd).

(Reference : Chapter III, Para 23)

TABLE D

Rapid quality survey in January, 1958

BENGAL AND BIHAR FIELDS

Grade II.

Railway	Total No. of checks carried out	Correct grade	One grade lower	Two grades lower (Unvendi- ble)	Average supplies per month (Tons)
Central . . . . .	..	..	..	..	..
Northern	4	2	2	..	13,900
Eastern	11	8	3	..	28,772
Southern . . . . .	..	..	..	..	..
Western . . . . .	..	..	..	..	..
North Eastern	2	2	..	..	3,890
South Eastern	11	7	4	..	7,784
TOTAL	28	*19	9	..	54,346

One sample for every 500 tons of coal received in major sheds where samples were drawn.

One sample for every 1941 tons on the basis of whole Railway.

*Out of these, 8 were better than the correct grade.

Percentage

Correct grade	67.8
One grade lower	32.2
Two grades lower	Nil.

APPENDIX No. 7(b).(contd.)

(Reference : Chapter III, Para 23)

TABLE E

Rapid quality survey in January, 1958

BENGAL AND BIHAR FIELDS

Railway	Quantity and nominal grade actually consumed during six months (In thousands of tons)	Percentage excess consumption due to supply not conforming to grade	Quantity required if the supply had been to specified grade (In thousands of tons)	Cost of quantity in col. (4) (Rs. in lakhs)	Quantity excess consumed (2-4) (in thousands tons)	Pithead cost of excess quantity consumed (Rs. in lakhs.)	Freight on quantity excess consumed (Rs. in lakhs)	Total extra expenditure (7 plus 8) (Rs. in lakhs)	Percentage of Col. (9) to Col. (5).
	2	3	4	5	6	7	8	9	10
Central . . .	721	14.95	627	249.4	93.8	18.6	18.6	37.2	14.9
Northern . . .	1031	9.33	943	360.8	88.1	17.2	16.5	33.7	9.3
Eastern . . .	1066	6.72	1000	273.8	66.4	13.0	5.4	18.4	6.7
Southern . . .	693	7.92	642	406.7	50.8	10.1	22.1	32.2	7.9
Western . . .	678	20.59	562	249.9	115.5	22.5	28.8	51.3	20.6
N. Eastern . . .	547	10.64	494	176.2	52.6	10.4	8.4	18.8	10.7
S. Eastern . . .	580	5.16	551	152.3	28.5	5.5	2.3	7.9	5.2
TOTAL . . .	5,316	10.3	4,819	1,869.1	495.7	97.3	102.1	199.5	10.7

Estimated extra expenditure annually 2 x Col. (9)=Rs. 399 lakhs.

NOTE.—The above table includes coal consumption on non-loco boilers which is roughly 10% of the total consumption. Thermal efficiency in non-loco boilers is somewhat higher and this will cause a difference in increased consumption of coal by about 0.7% which is insignificant.

APPENDIX No. 7 (b) (Contd.)
(Reference Chapter III, Para 23)
CENTRAL RAILWAY
Rapid Quality Survey in January 1958
DETAILS OF ANALYSIS
BENGAL AND BIHAR FIELDS

(Statement I)

	No. of samples analysed	No. of samples conforming with						Average increased consumption as against 100 tons of specified grade
		Sel. A	Sel. B	Gr. I	Gr. II	Gr. III A & III B	Un-vendible	
Specified Grade Sel. A .	23	3	5	9	5	1	..	$\left. \begin{aligned} &(3 \times 100 + 5 \times 103.95 + 9 \times 111.28 + 5 \times 125.45 + 1 \times 142.67) \div 23 \\ &= 112.66 \end{aligned} \right\}$
Increase in consumption over specified grade.	..	..	3.95%	11.28%	25.45%	42.67%	..	
Specified Grade Sel. B .	36	..	5	10	19	2	..	$\left. \begin{aligned} &(5 \times 100 + 10 \times 107.33 + 19 \times 121.5 + 2 \times 138.72) \div 36 \\ &= 115.26 \end{aligned} \right\}$
Increase in consumption over specified grade.	..	..	..	7.33%	21.5%	38.72	..	
Specified grade Gr. I .	18	..	2	4	4	8	..	$\left. \begin{aligned} &(2 \times 92.67 + 4 \times 100 + 4 \times 114.17 + 8 \times 131.39) \div 18 \\ &= 116.29 \end{aligned} \right\}$
Increase in consumption over specified grade	..	..	7.33%	..	14.17%	31.39%	..	
Specified Grade Gr. II .	Nil	..	..	..	..	..	..	}
Increase in consumption over specified grade.	..	..	..	..	..	..	..

Note : Relative percentage increases in coal consumption due to fall in grade are derived from Graph V. Chapter III.

ADDITIONAL EXPENDITURES (6 MONTHS) BASED ON RAPID QUALITY SURVEY IN JANUARY 1958

Specified grades	Quantity of specified grade actually consumed (Average for 6 months)	Percentage excess consumption due to supply not conforming to the specified grade	Quantity reqd. if the supply had been to the specified grade Col. (2) \times $100 \div (100 + \text{Col. 3})$	Cost of quantity in Col. (4) (Pithead cost plus Average freight)	Quantity excess consumed Col. (2) $-$ (4)	Pithead cost of excess quantity consumed	Freight on quantity excess consumed	Total extra expenditure Col. (7) $+$ Col. (8)	Percentage of Col. (9) to Col. (5)
	(Tons)	%	(Tons)	(Rs.)	(Tons)	(Rs.)	(Rs.)	(Rs.)	%
I	2	3	4	5	6	7	8	9	10
Sel. A . . .	208,406	12.66	184,987	75,65,960	23,419	4,91,799	4,66,038	9,57,837	12.66
Sel. B. . .	179,749	15.26	155,943	62,22,130	23,797	4,75,940	4,73,560	9,49,500	15.26
Gr. I . . .	332,398	16.29	285,835	1,11,53,300	46,563	8,90,285	9,26,604	18,16,889	16.20
Gr. II . . .	..	..	..	..	..	..	..	..	..
TOTAL . . .	720,544	14.95	626,765	2,49,41,390	93,779	18,58,024	18,66,202	37,24,226	14.95

Note : Based on Average Pithead Price per ton

Average freight per ton

Sel. A	Rs. 21.00
Sel. B.	20.00
Gr. I	19.12
Gr. II	18.00

Rs. 19.9

APPENDIX No. 7 (b) (Contd.)
(Reference : Chapter III, Para 23)
EASTERN RAILWAY
Rapid Quality Survey in January 1958
DETAILS OF ANALYSIS

BENGAL AND BIHAR FIELDS

Statement II

	No. of samples analysed	No. of Samples conforming with						Average increased consumption as against 100 tons of specified grade
		Sel. A	Sel. B	Gr. I	Gr. II	Gr. III-A&III B	Unvendible	
Specified grade Sel. A	8	5	..	2	1	..	..	$\left\{ (5 \times 100 + 2 \times 111.28 + 1 \times 125.45) \div 8 = 106.00 \right.$
Increase in consumption over specified grade	..	..	..	11.28%	25.45%	..	..
Specified grade Sel. B	20	2	5	8	3	2	..	$\left\{ (2 \times 96.05 + 5 \times 100 + 8 \times 107.33 + 3 \times 121.5 + 2 \times 138.72) \div 20 = 109.63 \right.$
Increase in consumption over specified grade	..	-3.95%	..	7.33%	21.5%	38.72%	..	
Specified grade Gr. I	46	7	8	8	12	11	..	$\left\{ (7 \times 88.72 + 8 \times 92.67 + 8 \times 100 + 12 \times 114.17 + 11 \times 131.39) \div 46 = 108.2 \right.$
Increase in consumption over specified grade	..	-11.28%	-7.33%	..	14.17%	31.39%	..	
Specified grade Gr. II	11	..	..	5	3	3	..	$\left\{ (5 \times 85.83 + 3 \times 100 + 3 \times 117.22) \div 11 = 98.26 \right.$
Increase in consumption over specified grade	..	..	..	-14.17%	..	17.22%	..	

Note:—Relative percentage increases in coal consumption due to fall in grade are derived from Graph V, Chapter III.

ADDITIONAL EXPENDITURE (6 MONTHS) BASED ON RAPID QUALITY SURVEY IN JANUARY, 1958

Specified grade	Quantity of specified grade actually consumed during 6 months	Percentage excess consumption due to supply not conforming to the specified grade	Quantity required if the supply had been to the specified grade Col. (2) $\times 100 \div$ [100 - Col. (3)]	Cost of quantity in Col. (4) (Pithead cost + freight)	Quantity excess consumed Cols. (2) - (4)	Pithead cost of excess quantity consumed	Freight on quantity excess consumed	Total extra expenditure Cols. (7) + (8)	Percentage of Col. (9) to Col. (5)
	Tons	%	Tons	Rs.	Tons	Rs.	Rs.	Rs.	%
I	2	3	4	5	6	7	8	9	10
Sel. A	84,040	6.00	79,283	23,07,135	4,757	99,897	38,532	1,38,429	6.00
Sel. B	273,306	9.63	249,298	70,05,290	24,008	4,80,160	1,94,465	6,74,625	9.63
Gr. I	535,942	8.21	495,280	1,34,81,500	40,662	7,77,457	3,29,362	11,06,819	8.21
Gr. II	172,634	-1.74	175,691	45,85,540	-3,057	-55,026	-24,762	-79,788	-1.74
TOTAL	1,065,922	6.72	999,552	2,73,79,465	66,370	13,02,488	5,37,597	18,40,085	6.72

Note :—Based on Average Pithead price per ton.

	Average freight/ton
	Rs.
Sel. A	21.00
Sel. B	20.00
Gr. I	19.12
Gr. II	18.00

APPENDIX No. 7 (b) (Contd.)
(Reference: Chapter III, Para 23)
NORTHERN RAILWAY

Rapid Quality Survey in January 1958

DETAILS OF ANALYSIS

BENGAL AND BIHAR FIELDS

(Statement III)

	No. of samples analysed	No. of Samples conforming with						Average increased consumption as against 100 tons of specified grade.
		Sel. A	Sel. B	Gr. I	Gr. II	Gr. III-A and III-B	Unvendible	
Specified Grade Sel. 'A'	8	6	1	1	..	..	..	$\left\{ \begin{aligned} &(6 \times 100 + 1 \times 103.95 + 1 \\ &111.28) \div 8 = 101.90 \end{aligned} \right.$
Increase in consumption over specified grade	..	..	3.95%	11.28%	..	..	..
Specified Grade Sel. 'B'	30	8	8	6	1	4	3	$\left\{ \begin{aligned} &8 \times 96.05 + 8 \times 100 + 6 \times \\ &107.33 + 1 \times 121.5 + 4 \\ &\times 138.72 + 3 \times 200 \div 30 \\ &= 116.29 \end{aligned} \right.$
Increase in consumption over specified grade.	..	-3.95%	..	7.33%	21.5%	38.72%	100	
Specified Grade Gr. I	42	2	12	11	7	9	1	$\left\{ \begin{aligned} &(2 \times 88.72 + 12 \times 92.67 + \\ &11 \times 100 + 7 \times 114.17 + \\ &9 \times 131.39 + 1 \times 200) \div \\ &42 = 108.84 \end{aligned} \right.$
Increase in consumption over specified Grade	..	-11.28%	-7.33%	..	14.17%	31.39%	100	
Specified Grade Gr. II	4	..	..	1	1	2	..	$\left\{ \begin{aligned} &(1 \times 85.83 + 1 \times 100 + 2 \times \\ &117.22) \div 4 = 105.07 \end{aligned} \right.$
Increase in consumption over specified grade	..	..	..	-14.17%	..	17.22%	..	

Note.—Relative percentage increases in coal consumption due to fall in grade are derived from Graph V Chapter III

ADDITIONAL EXPENDITURE (6 MONTHS) BASED ON RAPID QUALITY SURVEY IN JANUARY 1958

Specified Grade	Quantity of specified grade actually consumed (Average for six months)	Percentage excess consumption due to supply not conforming to the specified grade	Quantity required if the supply had been to the specified grade Col.(2) $\times 100 \div$ (100 plus Col. 3)	Cost of quantity in Col. (4) (Pithead cost plus freight)	Quantity excess consumed Cols. (2)—(4)	Pithead cost of excess quantity consumed	Freight on quantity excess consumed	Total extra expenditure Col.(7)+ Col.(8)	Percentage of Col. (9) to Col (5)
	Tons	%	Tons	Rs.	Tons	Rs.	Rs.	Rs.	
I	2	3	4	5	6	7	8	9	10
Sel. 'A'	157,520	1.90	154,583	61,36,940	2,937	61,677	54,922	1,16,599	1.90
Sel. 'B'	288,024	16.29	247,677	95,85,110	40,347	8,06,940	7,54,489	15,61,429	16.29
Gr. I	501,952	8.84	461,183	1,74,41,950	40,769	7,79,503	7,62,380	15,41,883	8.84
Gr. II	83,402	5.07	79,378	29,13,160	4,024	72,432	75,249	1,47,681	5.07
TOTAL	1,030,898	9.33	942,821	3,60,77,160	88,077	17,20,552	16,47,040	33,67,592	9.33

Note.—Based on Average Pithead prices per ton

	Average freight/ton
	Rs.
Sel. A	21.00
Sel. B	20.00
Gr. I	19.12
Grade II	18.00
	18.70

APPENDIX No. 7(b)—*contd.*
(Reference Chapter III, Para 23
NORTH EASTERN RAILWAY
Rapid quality survey in January 1958

DETAILS OF ANALYSIS
BENGAL AND BIHAR FIELDS

(Statement IV)

	No. of samples analysed	No. of Samples conforming with						Average increased consumption as against 100 tons of specified grade
		Sel. A	Sel. B	Gr. I	Gr. II	Gr. III-A and III-B	Unven- dible	
Specified grade Sel. A	8	7	..	..	..	1	..	$\left. \begin{aligned} &(7 \times 100 + 1 \times 142.67) \div 8 \\ &= 105.33 \end{aligned} \right\}$
Increase in consumption over specified grade	..	..	..	..	..	42.67%	..	
Specified grade Sel. B	14	4	3	2	2	3	..	$\left. \begin{aligned} &(4 \times 96.05 + 3 \times 100 + 2 \times \\ &107.33 + 2 \times 121.5 + 3 \times \\ &138.72) \div 14 \\ &= 111.29 \end{aligned} \right\}$
Increase in consumption over specified grade	..	-3.95%	..	7.33%	21.5%	38.72%	..	
Specified grade Gr. I	8	..	..	3	3	2	..	$\left. \begin{aligned} &(3 \times 100 + 3 \times 114.17 + 2 \times \\ &131.39) \div 8 \\ &= 113.16 \end{aligned} \right\}$
Increase in consumption over specified grade	..	..	..	..	14.17%	31.39%	..	
Specified grade Gr. II	2	..	..	..	2	..	..	$\left. \begin{aligned} &(2 \times 100) \div 2 \\ &= 100 \end{aligned} \right\}$
Increase in consumption over specified grade	..	..	..	..	..	..	..

Note.—Relative percentage increases in coal consumption due to fall in grade are derived from Graph V, Chapter III

ADDITIONAL EXPENDITURE (6 MONTHS BASED ON RAPID QUALITY SURVEY IN JANUARY 1958

Specified grade	Quantity of specified grade actually consumed (Average for 6 months)	Percentage excess consumption due to supply not conforming to the specified grade	Quantity required if the supply had been to the specified grade $\text{Col. (2)} \times \frac{100}{100 + \text{Col. (3)}}$	Cost of Quantity in Col. 4 (Pithead cost + Freight)	Quantity excess consumed $\text{Col. (2)} - (4)$	Pithead cost of excess quantity consumed	Freight on quantity excess consumed	Total extra expenditure $\text{Col. (7)} + (8)$	Percentage of Col. (9) to Col. (5)
	(Tons)	%	Tons	Rs.	Tons	Rs.	Rs.	Rs.	%
I	2	3	4	5	6	7	8	9	10
Sel. A	67,672	5.33	64,247	23,73,930	3,425	71,925	54,629	1,26,554	5.33
Sel. B	254,892	11.29	229,034	82,33,780	25,858	5,17,160	4,12,435	9,29,595	11.29
Grade I	200,772	13.16	177,423	62,22,230	23,349	4,46,433	3,72,417	8,18,850	13.16
Grade II	23,342	0	23,342	7,92,461	..	..	..	..	0
TOTAL	546,678	10.64	494,046	1,76,22,401	52,632	10,35,518	8,39,481	18,74,999	10.64

Note.—Based on average pithead prices per ton.

	Rs.	Average freight per ton Rs.
Sel. A	21.00	15.95
Sel. B	20.00	
Gr. I	19.12	
Gr. II	18.00	

APPENDIX No. 7 (b) —*contd.*
(Reference Chapter III, Para 23)
SOUTH EASTERN RAILWAY
Rapid quality survey in January 1958
DETAILS OF ANALYSIS
BENGAL AND BIHAR FIELDS

(Statement V)

	No. of samples analysed	Number of samples conforming with						Average increased consumption as against 100 tons of specified grade
		Sel. A	Sel. B	Gr. I	Gr. II	Gr. IIIA & IIIB	Un-vendible	
Specified grade Sel. A	14	11	1	2	..	..	..	$\frac{(11 \times 100 + 1 \times 103.95 + 2 \times 111.28)}{14} = 101.89$
Increase in consumption over specified grade.		..	3.95%	11.28%	..	..	..
Specified grade Sel. B	31	8	10	7	5	1	..	$\frac{96.05 + 10 \times 100 + 7 \times 07.33 + 5 \times 121.5 + 1 \times 138.72}{31} = 105.35$
Increase in consumption over specified grade		-3.95%	..	7.33%	21.5%	38.72%	..	
Specified grade Gr. I	43	7	12	8	12	2	2	$\frac{(7 \times 88.72 + 12 \times 92.67 + 8 \times 100 + 12 \times 114.17 + 2 \times 131.39 + 2 \times 200)}{43} = 106.18$
Increase in consumption over specified grade		-11.28%	-7.33%	..	14.17%	31.39%	100%	
Specified grade Gr. II	11	..	2	..	5	4	..	$\frac{(2 \times 78.5 + 5 \times 100 + 4 \times 11.22)}{11} = 102.35$
Increase in consumption over specified grade		..	-21.5%	..	..	17.22%	..	

Note.—Relative percentage increases in coal consumption due to fall in grade are derived from Graph V, Chapter III

ADDITIONAL EXPENDITURE (6 MONTHS) BASED ON RAPID QUALITY SURVEY IN JANUARY 1958

Specified Grade	Quantity of specified grade actually consumed (average for 6 months)	Percentage excess consumption due to supply not conforming to the specified grade	Quantity required if the supply had been to the specified grade $\text{col. 2} \times 100 \div (\text{100} + \text{col. 3})$	Cost of quantity in Col. 4 (Pithead cost + Freight)	Quantity excess consumed Cols. (2) — (4)	Pithead cost of excess quantity consumed	Freight on quantity excess consumed	Total extra expenditure cols. (7) — (8)	Percentage of col. (9) to col. (5)
	(Tons)	%	(Tons)	(Rs.)	(Tons)	(Rs.)	(Rs.)	(Rs.)	%
I	2	3	4	5	6	7	8	9	10
Sel. A	57,486	1.89	56,420	16,44,643	1,066	22,386	8,688	31,074	1.89
Sel. B	173,910	5.35	165,078	46,46,960	8,832	1,76,640	71,981	2,48,621	5.35
Grade I	301,796	6.18	284,230	77,50,970	17,566	3,35,862	1,43,163	4,79,025	6.18
Grade II	46,706	2.35	45,634	11,93,330	1,072	19,296	8,737	28,033	2.35
TOTAL	579,898	5.16	551,362	1,52,35,903	28,536	5,54,184	2,32,569	7,86,753	5.16

Note.—Based on average pit-head prices. per ton

	Average freight/ton.
	Rs.
Sel. A	21.00
Sel. B	20.00
Gr. I	19.12
Gr. II	18.00

18 R.B. 7.

APPENDIX No. 7(b)--Contd.
(Reference : Chapter III, Para 23)
SOUTHERN RAILWAY
Rapid quality survey in January 1958

DETAILS OF ANALYSIS
BENGAL & BIHAR FIELDS

	No. of samples analysed	No. of samples conforming with						Average increased consumption as against 100 tons of specified grade
		Sel. A	Sel. B	Gr. I	Gr. II	Gr. IIIA & IIIB	Un-vendible	
Specified Grade Sel. 'A' . . .	5	..	I	3	I	..	..	$\left\{ \begin{array}{l} (1 \times 103.95 + 3 \times 111.28 + 1 \times 125.45) \\ \div 5 = 112.65 \end{array} \right\}$
Increase in consumption over specified grade.	..	..	3.95%	11.28%	25.45%	..	..
Specified Grade Sel. 'B' . . .	31	I	7	20	3	..	..	$\left\{ \begin{array}{l} (1 \times 96.05 + 7 \times 100 + 20 \times 107.33 + 3 \times 121.5) \div 31 = 106.68 \end{array} \right\}$
Increase in consumption over specified grade.	..	3.95%	..	17.33%	21.5%	..	..
Specified Grade Gr. I	8	..	..	5	2	I	..	$\left\{ \begin{array}{l} (5 \times 100 + 2 \times 114.17 + 1 \times 131.39) \div 8 \\ = 107.47 \end{array} \right\}$
Increase in consumption over specified grade.	..	..	..	..	14.17%	31.39%	..	
Specified Grade Gr. II	Nil	..	..	..	..	..	..	}
Increase in consumption over specified grade.	..	..	..	..	..	..	..

NOTE :—Relative percentage increases in coal consumption due to fall in grade are derived from Graph V, Chapter III.

ADDITIONAL EXPENDITURE (6 MONTHS) BASED ON RAPID QUALITY SURVEY IN JANUARY 1958.

Specified grade	Quantity of specified grade actually consumed (Average for 6 months)	Percentage excess consumption due to supply not conforming to specified grade	Quantity required if the supply had been to the specified grade	Cost of quantity in Col. 4 (Pithead cost plus freight)	Quantity excess consumed	Pithead cost of excess quantity consumed	Freight on quantity excess consumed	Total extra expenditure	Percentage of Col. 9 to Col. 5
	Tons	%	Tons	Rs.	Tons	Rs.	Rs.	Rs.	%
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Sel. 'A' . . .	113,586	12.65	100,831	65,03,600	12,755	2,67,855	5,54,843	8,22,698	12.65
Sel. 'B' . . .	320,342	6.68	300,283	1,90,67,970	20,059	4,01,180	8,72,567	12,73,747	6.68
Gr. I	259,072	7.47	241,064	1,50,95,500	18,008	3,44,313	7,83,348	11,27,661	7.47
Gr. II	Nil	..	..	..	..	..	..	..	..
Total	693,000	7.92	642,178	4,06,67,070	50,822	10,13,248	22,10,758	32,24,106	7.92

NOTE :—Based on average pit-head prices

Average freight/Ton

	Per Ton.	
	Rs.	Rs.
Sel 'A'	21.00	
Sel 'B'	20.00	43.50
Gr. I	19.12	
Gr. II	18.00	

APPENDIX No. 7 (b)—*Concl'd.*
(Reference : Chapter III, Para 23)
WESTERN RAILWAY

Rapid Quality survey in January 1958

DETAILS OF ANALYSIS

BENGAL AND BIHAR FIELDS

(Statement VII)

	No. of samples analysed	No. of Samples Conforming with						Average increased consumption as against 100 tons of specified grade
		Sel. A	Sel. B	Gr. I	Gr. II	Gr. IIIA- & III B	Un-vendible	
Specified Grade Sel. A	Nil	..	..	..	..	..	..
Increase in consumption over specified Grade	..	..	..	..	..	..	..
Specified Grade Sel. B	22	5	2	..	9	6	..	$\left. \begin{aligned} &(5 \times 96.05 + 2 \times 100 + \\ &9 \times 121.5 + 6 \times 138.72 \\ &\div 22 = 118.46 \end{aligned} \right\}$
Increase in consumption over Specified Grade	..	-3.95%	..	..	21.5%	38.72%	..	
Specified Grade Gr. I	23	1	..	3	4	15	..	$\left. \begin{aligned} &(1 \times 88.72 + 3 \times 100 + \\ &4 \times 115.17 + 15 \times \\ &131.39) \div 23 = 122.45 \end{aligned} \right\}$
Increase in consumption over Specified Grade	..	-11.28%	..	..	14.17%	31.39%	..	
Specified Gr. II	Nil	..	..	..	..	..	..
Increase in consumption over Specified Grade.	..	..	..	..	..	..	..

NOTE :—Relative percentage increase s in coal consumption due to fall in grade are derived from the Graph V, Chapter III.

ADDITIONAL EXPENDITURE (6 MONTHS) BASED ON RAPID QUALITY SURVEY IN JANUARY, 1958.

Specified Grade	Quantity of specified grade actually consumed (Average for 6 months)	Per-centage excess consumption due to supply not conforming to the specified grade	Quantity required if the supply had been to the specified grade Col. 2 $\times 100 \div (100 + \text{col. 3})$	Cost of quantity in Col. (4) (Pithead cost + average freight)	Quantity excess consumed Col. (2) — (4)	Pithead Cost of excess quantity consumed	Freight on quantity excess consumed	Total extra expenditure cols. (7) + (8)	Percentage of col. (9) to col. (5)
	Tons	%	Tons	Rs.	Tons	Rs.	Rs.	Rs.	%
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Sel. A	..	..	..	..	..	..	..	..	..
Sel. B	318,560	18.46	268,918	1,20,74,400	49,642	9,92,840	12,36,090	22,28,930	18.46
Gr. I	359,260	22.45	293,393	1,29,15,200	65,867	12,59,380	16,40,090	28,99,470	22.45
Gr. II	..	..	..	..	..	..	..	..	..
TOTAL	677,820	20.59	562,311	2,49,89,600	115,509	22,52,220	28,76,180	51,28,400	20.59

NOTE : Based on Average Pithead Prices Per Ton

Average freight per ton

	Rs.
Sel. A	21.00
Sel. B	20.00
Gr. I	19.12
Gr. II	18.00

Rs.
24.90

APPENDIX No. 7(c)
(Reference : Chapter III, Para 25)

TABLE A

Rapid Quality survey in September, 1957

OUTLYING FIELDS

UNGRADED (OUTLYING FIELDS) WITH GRADE I TAKEN AS STANDARD COAL

Railway	Total No. of checks carried out	Correct grade	One grade lower	Two grades lower	More than two grades lower	Average supplies per mont (Tons)
Central	56	2	3	42	9	140,504
Southern	23	15	6	2	..	61,263
Western	22	19	3	..	..	47,678
South-Eastern	36	12	10	14	..	52,756
TOTAL	137	*48	22	58	9	302,201

One sample for every 500 tons of coal received in major sheds where samples were drawn.

One sample for every 2206 tons on the basis of whole railway.

Out of* these, 26 were better than the correct grade.

	Percentage
Correct grade	35.04
One grade lower	16.05
Two grades lower	42.34
More than two grades lower	6.57

TABLE B

Rapid Quality Survey in January, 1958

OUTLYING FIELDS

UNGRADED (OUTLYING FIELDS) WITH GRADE I TAKEN AS STANDARD COAL

Railway	Total No. of checks carried out	Correct grade	One grade lower	Two grades lower	More than two grades lower	Average supplies per mont (Tons)
Central	17	..	6	11	..	140,504
Southern	27	16	9	2	..	61,263
Western	3	1	2	..	..	47,678
South-Eastern	38	14	4	18	2	52,750
TOTAL	85	*31	21	31	2	302,20

One sample for every 500 tons of coal received in major sheds where samples were drawn.

One sample for every 3555 tons on the basis of whole railway.

*Out of these, 20 were better than the correct grade.

	Percentage
Correct grade	36.47
One grade lower	24.70
Two grades lower	36.47
More than two grades lower	2.36

APPENDIX No. 7(c)—*Concl'd.*
(Reference:—Chapter III, para 25)
Rapid Quality survey in september, 1957
DETAILS OF ANALYSIS
OUTLYING FIELDS

(Statement I)

	No. of samples analysed	No. of samples conforming with						Average increased consumption as against 100 tons of specified grade
		Sel. 'A'	Sel. 'B'	Grade I	Grade II	Gr. III-A & III-B	Unvendible	
I	2	3	4	5	6	7	8	9

CENTRAL RAILWAY

Ungraded (Chanda) . .	36	..	..	2	2	24	8	$\left. \begin{aligned} &(2 \times 100 + 2 \times 114.17 + 24 \times 131.39 + 8 \times 200) \div 36 = \\ &143.94 \end{aligned} \right\}$
Increase in consumption over specified grade. .				..	14.17%	31.39%	100%	
Ungraded (Deccan) . .	16	..	..	..	..	15	1	$\left. \begin{aligned} &(15 \times 131.39 + 1 \times 100) \div 16 = \\ &129.43 \end{aligned} \right\}$
Increase in consumption over specified grade						31.39%	100%	
Ungraded (C.I.C.) . .	4	..	..	..	1	3	..	$\left. \begin{aligned} &(1 \times 114.17 + 3 \times 131.39) \div 4 = \\ &127.09 \end{aligned} \right\}$
Increase in consumption over specified grade.					14.17%	31.39%		

SOUTHERN RAILWAY

Ungraded (C.I.C.) . .	5	..	..	1	4	..	..	$\left. \begin{aligned} &(1 \times 100 + 4 \times 114.17) \div 5 = \\ &111.34 \end{aligned} \right\}$
Increase in consumption over specified grade				..	14.17%	..	..
Ungraded (Talcher) . .	6	5	..	1	..	..	..	$\left. \begin{aligned} &(5 \times 88.72 + 1 \times 100) \div 6 = \\ &90.6 \end{aligned} \right\}$
Increase in consumption over specified grade.		-11.28	..	..	..	..	..
Ungraded (Singareni) . .	12	..	2	6	2	2	..	$\left. \begin{aligned} &(2 \times 92.67 + 6 \times 100 + 2 \times 114.17 + 2 \times 131.39) \div 12 = \\ &106.37 \end{aligned} \right\}$
Increase in consumption over specified grade.			-7.33%	..	14.17%	31.39%		

WESTERN RAILWAY

Ungraded (C.I.C.) . .	22	6	6	7	3	$\left. \begin{aligned} &(6 \times 88.72 + 6 \times 92.67 + 7 \times 100 + 3 \times 114.17) \div 22 = \\ &90.86 \end{aligned} \right\}$
Increase in consumption over specified grade.		-11.28%	-7.33%	..	14.17%			

SOUTH EASTERN RAILWAY

Ungraded (C.I.C.) . .	16	1	2	5	4	4	..	$\left. \begin{aligned} &(1 \times 88.72 + 2 \times 92.67 + 5 \times 100 + 4 \times 114.17 + 4 \times 131.39) \div 16 = 109.77 \end{aligned} \right\}$
Increase in consumption over specified grade.		-11.28%	-7.33%	..	14.17%	31.39%		
Ungraded (Talcher) . .	4	3	1	..	..	..	..	$\left. \begin{aligned} &(3 \times 88.72 + 1 \times 92.67) \div 4 = \\ &89.71 \end{aligned} \right\}$
Increase in consumption over specified grade.		-11.28%	-7.33%					
Ungraded (Pench) . .	16	..	..	..	6	10	..	$\left. \begin{aligned} &(6 \times 114.17 + 10 \times 131.39) \div 16 = \\ &124.93 \end{aligned} \right\}$
Increase in consumption over specified grade.					14.17%	31.93%		

NOTE :—1. Specified grade of coal from outlying fields is taken as Grade I.

2. Relative percentage increases in coal consumption due to fall in grade are derived from Graph V, Chapter III.

APPENDIX No. 7 (c)—Concl'd.
(Reference Chapter III, Para 25)
Rapid Quality Survey in January, 1958
DETAILS OF ANALYSIS
OUTLYING FIELDS

(Statement II)

	No. of samples analysed	No. of samples conforming with						Average increased consumption as against 100 tons of specified grade
		Sel. 'A'	Sel. 'B'	Grade I	Grade II	Gr. III-A & III-B	Unven-dible	
1	2	3	4	5	6	7	8	9
CENTRAL RAILWAY								
Ungraded (Singareni) . .	11	..	..	..	4	7	..	$\left\{ \begin{array}{l} (4 \times 114.17 + 7 \times 131.39) \div \\ 11 = 125.13 \end{array} \right.$
Increase in consumption over specified grade.					14.17%	31.39%		
Ungraded (C.I.C.) . .	4	..	..	..	1	3	..	$\left\{ \begin{array}{l} (1 \times 114.17 + 3 \times 131.39) \div \\ 4 = 127.09 \end{array} \right.$
Increase in consumption over specified grade.					14.17%	31.39%		
Ungraded (Chanda) . .	2	..	..	..	1	1	..	$\left\{ \begin{array}{l} (1 \times 114.17 + 1 \times 131.39) \div \\ 2 = 122.78 \end{array} \right.$
Increase in consumption over specified grade.					14.17%	31.39%		
SOUTHERN RAILWAY								
Ungraded (C.I.C.) . .	5	2	1	2	..	..	..	$\left\{ \begin{array}{l} (2 \times 88.72 + 1 \times 92.67 + 2 \times \\ 100) \div 5 = 94.02 \end{array} \right.$
Increase in consumption over specified grade.		-11.28%	-7.33%	..				
Ungraded (Talcher) . .	8	5	1	1	1	..	..	$\left\{ \begin{array}{l} (5 \times 88.72 + 1 \times 92.67 + 1 \\ 100 + 1 \times 114.17) \div 8 = \\ 93.81 \end{array} \right.$
Increase in consumption over specified grade.		-11.28%	-7.33%	..	14.17%	..	..
Ungraded (Singareni) . .	14	..	1	3	8	2	..	$\left\{ \begin{array}{l} (1 \times 92.67 + 3 \times 100 + 8 \times \\ 114.17 + 2 \times 131.39) \div 14 \\ = 112.06 \end{array} \right.$
Increase in consumption over specified grade.			-7.33%	..	14.17%	31.39%		
WESTERN RAILWAY								
Ungraded (C.I.C.) . .	3	..	..	1	2	..	..	$\left\{ \begin{array}{l} (1 \times 100 + 2 \times 114.17) \div 3 = \\ 109.45 \end{array} \right.$
Increase in consumption over specified grade.					14.17%			
SOUTH EASTERN RAILWAY								
Ungraded (C.I.C.) . .	20	1	5	4	4	6	..	$\left\{ \begin{array}{l} (1 \times 88.72 + 5 \times 92.67 + 4 \times \\ 100 + 4 \times 114.17 + 6 \times \\ 131.39) \div 20 = 109.85 \end{array} \right.$
Increase in consumption over specified grade.		-11.28%	-7.33%	..	14.17%	31.39%	..	
Ungraded (Talcher) . .	4	4	..	..	..	..	..	$\left\{ \begin{array}{l} (4 \times 88.72) \div 4 = 88.72 \end{array} \right.$
Increase in consumption over specified grade.		-11.28%	..	..	..	..	..
Ungraded (Pench) . .	14	..	..	..	..	12	2	$\left\{ \begin{array}{l} (12 \times 131.39 + 2 \times 200) \div 14 \\ = 141.19 \end{array} \right.$
Increase in consumption over specified grade.						31.39%	100%	

NOTE.—1. Specified grade of coal from outlying fields is taken as Grade I.

2. Relative percentage increases in coal consumption due to fall in grade are derived from Graph V Chapter III.

APPENDIX No. 8
(Reference : Chapter IV Paras 29, 31 and 32)
Statement showing the quantities of coal consumed, the rate of consumption of coal per 1000 gross ton miles, train miles, train engine and other engine hours, etc., in respect of the different services, Broad Gauge and Metre Gauge during the years 1938-39 and 1952-53 to 1956-57

Particulars	Passenger and proportion of mixed				Goods and proportion of mixed				Passenger, mixed and goods services			
Year	B. G.	(+) or (-) % over 1952-53	M. G.	(+) or (-) % over 1952-53	Total	(+) or (-) % over 1952-53	B. G.	(+) or (-) % over 1952-53	Total	(+) or (-) % over 1952-53	M. G.	(+) or (-) % over 1952-53
Tons of coal consumed (in thousands)												
1938-39	2,112		649		2,761		2,763		3,275		1,161	
1952-53	2,320	..	938	..	3,258	..	3,952	..	4,794	..	1,780	..
1953-54	2,356	+1.55	977	+4.16	3,333	+2.30	3,973	+0.58	4,797	+0.06	1,837	+3.20
1954-55	2,467	+6.34	995	+6.08	3,462	+6.26	4,173	+5.59	5,024	+4.80	1,846	+5.87
1955-56	2,494	+7.50	1,037	+10.55	3,531	+8.37	4,418	+11.79	5,378	+12.18	1,957	+12.19
1956-57	2,653	+14.36	1,082	+15.35	3,735	+14.64	4,800	+21.46	5,814	+21.28	2,096	+17.75
Lb. of coal consumed per 1000 gross ton miles												
1938-39	180.2		200.1		184.5		142.4		143.5		174.1	
1952-53	186.3	..	226.8	..	196.6	..	166.5	..	172.3	..	214.4	..
1953-54	182.5	-2.04	225.1	-0.75	193.6	-1.53	163.3	-1.92	170.5	-1.04	213.8	-0.28
1954-55	184.7	-0.85	221.3	-2.43	193.9	-1.37	161.1	-3.24	165.6	-3.89	206.4	-3.73
1955-56	182.0	-2.31	221.0	-2.56	191.9	-2.39	153.8	-7.63	158.8	-7.84	203.0	-5.32
1956-57	185.2	-0.59	218.6	-3.62	193.8	-1.42	152.4	-8.47	156.8	-9.00	197.2	-8.02
Gross ton miles (including weight of engine) (in millions)												
1938-39	26,249		7,259		33,508		43,456		51,133		14,936	
1952-53	27,914	..	9,212	..	37,126	..	52,930	..	62,317	..	18,599	..
1953-54	28,842	+3.32	9,715	+5.46	38,557	+3.85	53,495	+1.07	63,027	+1.14	19,247	+3.48
1954-55	29,925	+7.20	10,068	+9.29	39,993	+7.72	58,007	+9.59	67,975	+9.08	20,036	+7.73
1955-56	30,701	+9.98	10,520	+14.20	41,221	+11.03	64,342	+21.56	75,856	+21.73	22,034	+18.47
1956-57	32,089	+14.96	11,092	+20.41	43,181	+16.31	70,329	+32.87	83,041	+33.26	23,804	+27.99
Train miles (in thousands)												
1938-39	68,679		34,137		102,816		47,384		66,142		52,895	
1952-53	59,765	..	35,881	..	95,646	..	50,845	..	71,285	..	56,321	..
1953-54	61,476	+2.86	37,564	+4.69	99,040	+3.55	50,431	-0.81	70,364	-1.29	57,497	+2.09
1954-55	63,013	+5.43	38,080	+6.15	101,102	+5.70	53,269	+4.77	73,442	+3.03	58,262	+3.45
1955-56	63,830	+6.80	39,187	+9.21	103,017	+7.71	57,147	+12.40	78,905	+10.69	60,945	+8.21
1956-57	65,936	+10.33	40,017	+11.53	105,953	+10.78	60,094	+18.19	83,012	+16.45	62,935	+11.74
Other engine miles (in thousands)												
1938-39	5,170		2,084		7,254		22,853		30,398		9,629	
1952-53	4,928	..	2,801	..	7,819	..	29,419	..	39,093	..	12,565	..
1953-54	5,071	+2.90	2,809	-2.84	7,880	+0.78	30,132	+2.42	40,010	+2.35	12,687	+0.97
1954-55	5,345	+8.46	2,694	-6.82	8,039	+2.81	30,606	+4.03	40,583	+3.81	12,671	+0.84
1955-56	5,587	+13.37	2,715	-6.09	8,302	+6.18	32,267	+9.68	43,387	+10.98	13,835	+10.11
1956-57	5,788	+17.45	2,846	-1.56	8,634	+10.42	34,168	+16.14	46,000	+17.67	14,678	+16.82
Total engine miles (in thousands)												
1938-39	73,849		36,221		110,070		70,237		96,540		62,524	
1952-53	64,693	..	38,772	..	103,465	..	80,264	..	110,378	..	68,886	..
1953-54	66,547	+2.87	40,373	+4.13	106,920	+3.33	80,563	+0.37	114,025	+3.30	70,184	+1.88
1954-55	68,358	+5.67	40,783	+5.19	109,141	+5.49	83,875	+4.50	114,025	+3.30	70,933	+2.97
1955-56	69,417	+7.30	41,902	+7.07	111,319	+7.59	89,414	+17.40	122,292	+10.79	74,780	+8.56
1956-57	71,724	+10.87	42,863	+10.55	114,587	+10.75	94,262	+17.44	129,012	+16.88	77,613	+12.67
Total												
1938-39	6,036											
1952-53	8,052	+0.97										
1953-54	8,130	+5.39										
1954-55	8,486	+10.64										
1955-56	8,909	+18.59										
1956-57	9,549											
Total												
1938-39	159.7											
1952-53	181.4	..										
1953-54	179.3	-1.16										
1954-55	176.1	-2.92										
1955-56	170.5	-6.01										
1956-57	169.5	-6.56										
Total												
1938-39	84,641											
1952-53	99,443	+2.15										
1953-54	101,584	+8.57										
1954-55	107,968	+17.73										
1955-56	117,077	+26.93										
1956-57	126,222											
Total												
1938-39	168,958											
1952-53	166,931	..										
1953-54	169,404	+1.48										
1954-55	174,544	+4.56										
1955-56	181,922	+8.98										
1956-57	188,965	+13.20										
Total												
1938-39	37,652											
1952-53	46,912	+2.08										
1953-54	47,890	+3.65										
1954-55	48,622	+10.18										
1955-56	51,689	+16.46										
1956-57	54,634											
Total												
1938-39	206,610											
1952-53	213,843	+1.61										
1953-54	217,294	+4.36										
1954-55	223,166	+9.24										
1955-56	233,611	+13.91										
1956-57	243,599											

NOTE:—Figures are exclusive of departmental

APPENDIX No. 8 (concl'd)

Particulars	Year	Passenger and proportion of mixed				Goods and proportion of mixed				Passenger, mixed			
		B.G.	(+) or (-) % over 1952-53	Total	(+) or (-) % over 1952-53	B.G.	(+) or (-) % over 1952-53	M.G.	(+) or (-) % over 1952-53	Total	(+) or (-) % over 1952-53	M.G.	(+) or (-) % over 1952-53
Train engine hours (in thousands)	1938-39	3,129		5,041		4,244		1,629		5,873		3,541	
	1952-53	3,012	..	5,233	..	4,920	..	2,165	..	7,085	..	4,386	..
	1953-54	3,125	+3.75	5,411	+3.40	4,989	+1.40	2,151	+0.65	7,140	+2.29	4,437	+1.16
	1954-55	3,194	+6.04	5,531	+5.59	5,302	+7.76	2,235	+3.38	7,537	+6.74	4,572	+4.24
	1955-56	3,258	+8.17	5,692	+8.77	5,863	+19.17	2,511	+15.98	8,374	+14.99	4,945	+17.85
	1956-57	3,397	+12.78	5,878	+12.33	6,309	+28.23	2,688	+24.16	8,997	+22.37	5,169	+17.85
Other engine hours (in thousands)	1938-39	1,611		2,466		4,796		1,681		6,477		2,36	
	1952-53	1,683	..	2,688	..	6,666	..	2,213	..	8,879	..	3,218	..
	1953-54	1,756	+4.34	2,779	+3.39	6,903	+3.56	2,276	+2.85	9,179	+3.71	3,299	+2.52
	1954-55	1,851	+9.98	2,868	+6.70	7,061	+5.93	2,319	+4.79	9,380	+6.74	3,336	+3.67
	1955-56	1,914	+13.73	2,972	+10.57	7,525	+12.89	2,561	+15.73	10,086	+13.06	3,619	+12.46
	1956-57	1,968	+16.9	3,063	+13.95	8,079	+21.20	2,686	+21.37	10,765	+20.34	3,781	+17.50
Total engine hours (in thousands)	1938-39	4,740		7,507		9,040		3,310		12,350		6,077	
	1952-53	4,695	..	7,921	..	11,866	..	4,378	..	15,964	..	7,604	..
	1953-54	4,881	+3.96	8,190	+3.40	11,892	+2.64	4,427	+1.12	16,319	+2.22	7,736	+1.74
	1954-55	5,045	+7.45	8,399	+6.03	12,363	+6.71	4,554	+4.02	16,917	+5.97	7,908	+3.99
	1955-56	5,172	+10.16	8,664	+9.38	13,388	+15.55	5,072	+15.85	18,460	+14.00	8,564	+12.62
	1956-57	5,365	+14.27	8,941	+12.88	14,388	+24.18	5,374	+22.75	19,762	+21.33	8,950	+17.50
Gross loads of trains (in- cluding weight of en- gine (in tons)	1938-39	382		325		917		409		773		282	
	1952-53	467	..	388	..	1,041	..	459	..	874	..	330	..
	1953-54	469	+0.43	389	+0.26	1,061	+1.92	478	+4.14	895	+2.40	335	+0.68
	1954-55	475	+1.71	396	+2.06	1,089	+4.61	494	+7.63	926	+3.42	344	+1.52
	1955-56	481	+3.00	400	+3.09	1,126	+8.17	529	+15.25	961	+7.52	361	+4.24
	1956-57	487	+4.28	408	+5.15	1,170	+12.39	555	+20.92	1,000	+11.22	378	+9.39
Gross loads of trains (ex- cluding weight of en- gine) (in tons)	1938-39	285		243		806		350		677		227	
	1952-53	354	..	293	..	910	..	389	..	760	..	263	..
	1953-54	357	+0.85	295	+0.68	928	+1.98	407	+4.63	780	+2.63	267	+1.52
	1954-55	363	+2.54	300	+2.39	955	+4.95	422	+8.48	808	+6.32	275	+4.56
	1955-56	365	+3.11	302	+3.07	988	+8.57	454	+16.71	841	+10.66	290	+10.27
	1956-57	367	+3.67	306	+4.44	1,027	+12.86	479	+23.14	876	+15.26	306	+16.35
Average weight of engine (in tons)	1938-39	97		83		111		59		96		55	
	1952-53	113	..	95	..	131	..	70	..	114	..	67	..
	1953-54	112	+0.89	94	+1.05	133	+1.53	71	+1.43	115	+0.88	68	+1.49
	1954-55	112	+0.89	94	+1.05	134	+1.29	72	+2.86	118	+3.51	69	+2.98
	1955-56	116	+2.65	98	+3.16	138	+5.34	75	+7.14	120	+5.26	71	+3.85
	1956-57	120	+6.19	102	+7.37	143	+9.16	76	+8.57	124	+8.77	72	+7.46

Note—Figures are exclusive of departmental.

APPENDIX 9
(Reference: Chapter IV, Para 33)
Statement showing Number of B. G. and M. G. Locomotives Working on Passenger, Mixed and Goods Services according to age groups during 1952-53 and 1954-55 to 1956-57.

Railway	Type of service	0-5 Years			6-10 Years			11-20 Years			Over 20 Years			Total		
		B.G.	M.G.	Total	B.G.	M.G.	Total	B.G.	M.G.	Total	B.G.	M.G.	Total	B.G.	M.G.	Total
1952-53																
Western	Passenger Mixed Goods	76	136	212	83	55	138	..	83	83	260	296	556	419	570	989
		161	..	161	52	..	52	6	..	6	379	..	379	598	..	598
		..	136	136	..	157	157	..	43	43	..	442	442	..	778	778
		130	..	130	184	..	184	19	..	19	515	..	515	848	..	848
		75	131	206	87	39	126	32	57	89	227	463	690	421	690	1,111
		147	..	147	227	..	227	29	..	29	715	..	715	1,118	..	1,118
		159	12	171	224	13	237	24	8	32	543	115	658	950	148	1,098
TOTAL		748	415	1,163	857	264	1,121	110	191	301	2,639	1,316	3,955	4,354	2,186	6,540
Percentage of total engines		17.2%	19.0%	17.8%	19.7%	12.1%	17.1%	2.5%	8.7%	4.6%	60.6%	60.2%	60.5%	..	..	..
1954-55																
Western	Passenger Mixed Goods	43	129	172	155	80	235	15	44	59	251	312	563	464	561	1,025
		167	..	167	106	..	106	6	..	6	369	..	369	648	..	648
		..	199	199	..	42	42	..	198	198	..	537	537	..	976	976
		92	..	92	219	..	219	54	..	54	476	..	476	841	..	841
		74	133	207	117	50	167	29	36	65	210	455	665	1,430	674	1,104
		127	..	127	162	..	162	119	..	119	694	..	694	1,102	..	1,102
		159	12	171	224	13	237	24	8	32	543	115	658	950	148	1,098
TOTAL		662	473	1,135	983	185	1,168	247	286	533	2,543	1,419	3,962	4,435	2,359	6,794
Percentage of total engines		14.9%	20.0%	16.6%	22.1%	7.8%	17.2%	5.6%	12.1%	7.8%	57.5%	60.1%	58.4%	..	..	..

APPENDIX 9 (concl'd)
(Reference: Chapter IV, Para 33)
Statement showing Number of B.G. and M.G. Locomotives Working on Passenger, Mixed and Goods Services according to age groups during 1952-53 and 1954-55 to 1956-57

Railway	Type of service	0-5 Years			6-10 Years			11-20 Years			Over 20 Years			Total		
		B.G.	M.G.	Total	B.G.	M.G.	Total	B.G.	M.G.	Total	B.G.	M.G.	Total	B.G.	Total	
		1955-56														
Western	Passenger Mixed Goods	102	157	259	115	85	200	32	67	99	229	301	530	478	610	1,088
South Eastern		211	..	211	146	..	146	6	..	6	363	..	363	726	..	726
North Eastern		..	113	113	..	235	235	..	198	198	..	..	524	524	..	1,070
Central		180	..	180	126	..	126	140	..	140	371	..	371	817	..	817
Southern		82	152	234	144	45	189	29	53	82	205	432	637	460	682	1,142
Eastern		123	..	123	187	..	187	164	..	164	685	..	685	1,159	..	1,159
Northern		191	33	224	204	14	218	96	12	108	488	126	614	979	185	1,164
TOTAL		889	455	1,344	922	379	1,301	467	330	797	2,341	1,383	3,724	4,619	2,547	7,166
Percentage of total engines		19.3%	17.9%	18.8%	20.6%	14.9%	18.2%	10.1%	12.9%	11.1%	50.7%	54.3%	51.9%	..	..	..
1956-57																
Western	Passenger Mixed Goods	137	191	328	50	109	159	108	55	163	214	310	524	509	665	1,174
South Eastern		207	..	207	139	..	139	53	..	53	356	..	356	755	..	755
North Eastern		..	215	215	..	200	200	..	208	208	..	..	541	541	..	1,164
Central		255	..	255	113	..	113	106	..	106	355	..	355	829	..	829
Southern		122	202	324	92	50	142	70	47	117	185	416	601	469	715	1,184
Eastern		179	..	179	159	..	159	205	..	205	655	..	655	1,198	..	1,198
Northern		197	75	272	199	16	215	143	12	155	492	111	603	1,031	214	1,245
TOTAL		1,097	683	1,780	752	375	1,127	685	322	1,007	2,257	1,378	3,635	4,791	2,758	7,549
Percentage of total engines		22.9%	24.7%	23.6%	15.6%	13.6%	14.9%	14.3%	11.7%	13.3%	47.1%	50.0%	48.2%	..	..	..

APPENDIX No. 10
(Reference: Chapter V, Para 39)
Results of Re-weighments of Coal Wagons at Colliery Base Stations situated on the Eastern, Central and South Eastern Railways

WAGONS RE-WEIGHED										NET RESULTS						
S.No.	Date of check	Station	Average daily receipt of coal wagons		No.	Total		With same weight		With over-weight		With under-weight		Percent- age of over-weight to average invoiced weight	Percent- age of over-weight to average under-weight to weight invoiced	Remarks or under-weight to total weight of wagons
			No.	Weight Tons	No.	Invoiced Weight tons	No.	No.	Weight tons	No.	Over-weight tons	No.	Under-weight tons			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
EASTERN RAILWAY																
1.	11-12-57	Ondal	720	15,920	60	1,356	8	31	7.75	21	3.57	1.46	0.80	0.12	..	
2.	29-12-57	Do.	720	15,920	60	1,329	7	50	9.00	3	0.21	0.86	0.30	0.66	..	
3.	12-12-57	Sitarampur	400	9,080	58	1,317	36	14	3.50	8	4.00	1.46	2.20	..	0.04	
4.	30-12-57	Do.	400	9,080	41	950	14	30	9.00	7	4.90	1.30	3.06	0.43	..	
5.	14-12-57	Kusunda	450	10,193	58	1,312	12	40	8.00	6	0.60	0.88	0.44	0.56	..	
6.	18-12-57	Do.	450	10,193	31	685	11	12	1.20	8	1.12	0.45	0.63	0.01	..	
7.	16-12-57	Berno	180	4,059	63	1,436	5	20	6.00	38	10.64	1.30	1.20	..	0.32	
8.	20-12-57	Do.	180	4,059	55	1,277	10	27	13.77	18	5.04	2.20	1.20	0.68	..	
9.	17-12-57	Patherdih	600	13,740	50	1,146	12	27	3.24	11	1.32	0.52	0.53	0.17	..	
10.	19-12-57	Do.	600	13,740	54	1,218	13	32	5.44	9	1.35	0.75	0.64	0.34	..	
TOTAL			..	..	530	12,026	118	283	66.90	129	32.75	..	..	0.28	..	
CENTRAL RAILWAY																
1.	16-12-57	Jumadeo	300	6,600	42	738	15	16	2.72	11	1.43	0.71	0.56	0.56	..	
2.	25-12-57	Do.	300	6,600	66	1,503	8	8	1.20	50	8.50	0.66	0.74	..	0.49	
3.	2-1-58	Do.	300	6,600	67	1,545	19	22	3.74	26	4.68	0.74	0.78	..	0.06	
4.	22-12-57	Wardha	40	880	29	650	6	10	3.20	13	3.64	1.42	1.26	..	0.07	
5.	31-12-57	Do.	40	880	15	329	4	7	2.38	4	0.40	1.56	0.45	0.60	..	
6.	4-1-58	Do.	40	880	21	461	4	2	0.70	15	6.75	1.62	2.04	..	1.31	
7.	18-12-57	Bhadrachalam Rd.	140	3,080	28	640	1	2	1.66	25	14.50	3.69	2.53	..	2.01	

APPENDIX No. 10 (Contd.)
(Reference : Chapter V, Para 39)

Results of Re-weighments of Coal Wagons at Colliery Base Stations situated on the Eastern, Central and South Eastern Railways

Serial No.	Date of check	Station	WAGONS RE-WEIGHED										NET RESULTS					
			Average daily receipt of coal wagons		Total		With same weight		With over-weight		With under-weight		Percentage of over-weight to average invoiced weight		Percentage of under-weight to average invoiced weight		Percentage of net over-weight or under-weight to total weight of wagons	
			No.	Weight tons	No.	Invoiced Weight tons	No.	Weight tons	No.	Weight tons	No.	Weight tons	No.	Under-weight tons	No.	Under-weight tons
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17		
CENTRAL RAILWAY (contd.)																		
8.	28-12-57	Bhadrachalam Road	140	3,080	28	644	28	24.64	..	3.82	..	3.82	Weighed by measurement as weighed bridge was out of order.		
9.	7-1-58	Do.	140	3,080	92	2,057	7	17	24.48	68	74.12	6.49	4.86	..	2.41			
10.	25-12-57	Hirdagarh	35	770	21	499	..	4	0.20	17	3.06	0.21	0.78	..	0.57			
11.	11-1-58	Do.	35	770	49	1,139	..	11	2.64	38	15.96	1.04	1.81	..	1.17			
12.		Belampalli	85	1,870	20	478	12	10	2.20	8	2.56	0.94	1.30	..	0.08			
13.	9-1-58	Do.	85	1,870	26	620	13	13	6.11	13	5.98	1.98	1.92	0.02	..			
TOTAL			504	11,303	66	122	51.23	316	166.22	1.02			
SOUTH-EASTERN RAILWAY																		
1.	12-12-57	Bhaga	300	6,600	38	874	13	10	2.00	15	1.50	0.9	0.45	0.06	..			
2.	20-12-57	Do.	300	6,600	40	912	6	14	3.84	20	3.00	1.2	0.67	0.09	..			
3.	12-12-57	Mohuda	250	5,500	19	439	7	6	0.60	6	0.72	0.43	0.56	..	0.03			
4.	20-12-57	Do.	250	5,500	39	913	6	16	2.40	17	1.70	0.65	0.44	0.08	..			
5.	13-12-57	Bhojudih	430	9,460	42	958	8	24	3.60	10	1.50	0.66	0.65	0.22	..			
6.	21-12-57	Do.	430	9,460	7	138	2	2	0.24	3	0.30	0.54	0.46	..	0.04			
7.	14-12-57	Radhanagar	230	5,060	39	908	7	14	2.38	18	3.60	0.75	0.86	..	0.13			
8.	22-12-57	Do.	230	5,060	48	1,098	6	26	5.72	16	5.1	1.00	1.40	0.05	..			
9.	17-12-57	Manendragarh	230	5,060	59	1,378	3	44	17.60	12	4.80	1.70	1.70	0.93	..			
10.	18-12-57	Do.	230	5,060	45	1,055	1	42	18.90	2	0.90	1.90	1.80	1.71	..			
TOTAL			376	8,673	59	198	57.28	119	23.14	0.39	..			

APPENDIX No. 11 (a)
(Reference: Chapter V, Para 40)
Results of Re-weighments of Coal Wagons at Various Loco Sheds by Inspectors Deputed by the Expert Coal Committee

No.	Date of check	Station	WAGONS RE-WEIGHED										NET RESULTS			Remarks
			Average daily receipt of coal wagons		Total	With over-weight		With under-weight		Percentage of over-weight to average weight invoiced	Percentage of under-weight to average weight invoiced	Percentage of net over-weight or under-weight to weight of wagons				
			No.	Weight tons		No.	Weight tons	No.	Weight tons							
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
EASTERN RAILWAY																
1	24-12-57	Asansol	28	616	22	503	1	11	3.74	10	2.90	1.50	1.26	0.17	..	
2	26-12-57	Howrah	14	308	16	357	..	11	5.39	5	1.80	2.22	1.57	1.06	..	
3	27-12-57	Gaya	21	462	4	83	..	1	0.15	3	0.66	0.65	1.01	..	0.58	
TOTAL			..	..	42	948	1	23	9.28	18	5.36	..	..	0.41	..	
NORTH EASTERN RAILWAY																
1	20-1-58	Barabanki	15	330	9	199	..	2	0.45	7	2.70	1.02	1.77	..	1.13	
2	22-1-58	Do.	15	330	11	244	1	5	9.35	5	3.10	8.49	2.77	2.56	..	
3	24-1-58	Bareilly	10	220	6	138	..	..	..	6	4.50	..	3.26	..	3.26	
4	25-1-58	Do.	10	220	17	395	3	4	1.55	10	5.05	1.74	2.11	..	0.89	
5	6-2-58	Gorakhpur	25	425	24	356	1	..	..	23	23.35	..	6.84	..	6.56	
TOTAL			..	..	67	1332	5	11	11.35	51	38.70	..	..	..	2.05	
NORTHERN RAILWAY																
1	13-1-58	Varanasi Cantt.	2	44	4	88	1	2	0.70	1	0.25	1.6	1.2	0.51	..	
2	15-1-58	Bareilly	3	66	4	89	..	..	..	4	0.60	..	0.67	..	0.67	
3	16-1-58	Ghaziabad	8	176	8	185	..	4	2.40	4	2.40	2.6	2.6	..	..
4	18-1-58	Ambala Cantt.	11	232	6	134	..	1	0.20	5	1.75	0.9	1.6	..	1.16	
TOTAL			..	..	22	496	1	7	3.30	14	5.00	..	..	..	0.34	

APPENDIX No. II (a) (Contd.)
(Reference: Chapter V, Para 40)

Results of Re-weighments of Coal Wagons at Various Loco Sheds By Inspectors Deputed by the Expert Coal Committee

S. No.	Date of check	Station	WAGONS RE-WEIGHED										NET RESULTS			
			Average daily receipt of coal wagons		With same weight		With over-weight		With under-weight		Percentage of over-weight to average invoiced weight		Percentage of under-weight to average invoiced weight		Remarks	
			No.	Weight tons	No.	Weight (as per invoice) Tons	No.	Over-weight tons	No.	Under-weight tons	to average invoiced weight	to average invoiced weight	percentage of net over-weight or under-weight to total weight of wagons			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	16	17	
WESTERN RAILWAY																
1	31-12-57	Sabarmati	11	242	5	117	..	..	..	5	3.00	..	2.6	..	2.6	By measurement
2	24-1-58	Agra East Bank	63	1,386	30	687	3	24	14.40	3	0.69	2.62	0.99	1.91	..	..
3	27-1-58	Phulera	11	242	8	187	..	7	4.76	1	0.20	2.90	0.87	2.44	..	..
4	12-1-58	Baroda	18	396	18	403	1	15	3.00	2	1.04	0.89	2.30	0.49	..	..
..	..	TOTAL	..	..	61	1,394	4	46	22.16	11	4.93	..	..	1.24	..	..
CENTRAL RAILWAY																
1	15-1-58	Dhond	16	352	29	756	1	17	7.31	11	6.49	1.90	2.56	0.11	..	..
2	17-1-58	Jabalpur	17	374	18	405	..	1	0.60	17	14.98	3.19	4.14	..	3.55	..
3	21-1-58	Nagpur (Ajni)	19	418	3	67	..	3	3.39	..	..	5.07	..	5.07	..	..
4	6-1-58	hansi	25	550	9	195	1	1	0.25	7	4.55	1.10	3.10	..	2.20	..
5	7-1-58	Jabalpur	17	374	5	117	..	..	..	5	6.00	..	5.15	..	5.15	..
6	9-1-58	Katni-Marwarah	12	264	4	84	..	..	..	4	2.80	..	3.33	..	3.33	..
..	..	TOTAL	..	..	68	1,624	2	22	11.55	44	31.82	..	..	..	1.43	..
SOUTH EASTERN RAILWAY																
1	9-1-58	Bilaspur	13	286	8	176	1	3	0.90	4	1.20	1.40	1.30	..	0.17	..
2	11-1-58	Tatanagar	11	242	5	113	..	5	1.00	..	..	0.89	..	0.89	..	..
3	11-1-58	Kharagpur	19	418	11	251	1	8	2.60	2	0.30	1.40	0.70	0.92	..	..
..	..	TOTAL	..	..	24	540	2	16	4.50	6	1.50	..	..	0.55	..	..

APPENDIX No. II (a) (conold)
(Reference : Chapter V, Para 40)
Results of Re-weighment of Coal Wagons at Various Loco Sheds by Inspectors Deputed by the Expert Coal Committee

S. No.		Date of check	Station	WAGONS RE-WEIGHED										NET RESULTS			
				Average daily receipt of coal wagons		Total		With same weight		With over-weight		With under-weight		Percentage of over-weight to average invoiced weight		Percentage of under-weight to average invoiced weight	
				No.	Weight tons	No.	Weight tons	No.	Weight tons	No.	Weight tons	No.	Weight tons	to average invoiced weight	to average invoiced weight	of net over-weight or under-weight to total weight of wagns	Remarks
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
SOUTHERN RAILWAY																	
1	31-1-58	Bezwaia	16	352	15	337	1	3	1.55	11	6.05	2.40	2.40	..	1.30		
2	1-2-58	Bitra Gunta	12	264	15	332	..	3	1.20	12	16.00	1.80	6.00	..	4.50		
3	3-2-58	Guntakal	8	176	17	379	..	1	.30	16	26.00	BG MG2.30	BG 7.80 MG3.40	..	6.80		
4	4-2-58	Raichur	5	110	15	344	1	4	2.00	10	4.00	2.00	1.70	..	.60		
Total				..	..	62	1,392	2	11	5.05	49	52.05	..	..	3.38	..	

APPENDIX No. II (b)
(Reference : Chapter V, Para 40)
Results of Re-weighments of Coal Wagons at Various Loco Sheds by Railways at the Instance of the Expert Coal Committee
December, 1957

S. No.	Date of check	Station	Average daily receipt of coal wagons		WAGON RE-WEIGHED										NET RESULTS				Remarks
			No.	Weight tons	No.	Weight tons	Total		With over-weight		With under-weight		No.	Under-weight tons	Percent- age of weight to average invoiced weight	Percent- age of weight to average invoiced weight	Percentage of net over-weight under-weight to total weight of wagons		
							Invoiced Weight tons	With same weight	No.	Over- weight tons	No.	Under- weight tons							
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17			
CENTRAL RAILWAY																			
1	23-12-57	Aini	14	308	18	376	16	22.80	2	0.45	1.18	5.95	..	..	..	..
2	30-12-57	Do.	..	..	10	217	9	25.95	1	0.35	13.41	11.78	..	..	..	..
3	25-12-57	Wardha	5	110	7	161	..	..	7	3.00	..	1.87	..	..	1.87	..	
4	31-12-57	Do.	..	..	11	238	8	2.35	1	0.40	5.45	0.82	..	..	..	..
5	24-12-57	Bhusawal	36	792	22	501	1	17	14.00	4	0.95	3.63	1.06	2.60	..	..	
6	25-12-57	Do.	..	..	19	429	1	16	17.55	2	1.70	4.88	3.69	3.70	..	..	
7	29-12-57	Jhansi	19	418	22	478	6	..	..	16	8.40	..	2.41	1.76	..	..	
TOTAL				..	..	108	2,400	16	82.65	33	15.25	..	..	3.06	..	..	
EASTERN RAILWAY																			
1	18-12-57	Naihati	7	154	6	135	1	1	.05	4	.50	.22	.54	..	..	.33	
2	25-12-57	Do.	..	..	6	137	2	3	.30	1	.05	.43	.22	18	..	..	
3	17-12-57	Chitpur	12	264	6	137	2	1	.05	3	.20	.23	.35	..	..	.11	
4	23-12-57	Do.	..	..	6	134	2	1	.05	3	.25	.23	.38	..	..	.15	

APPENDIX II (b)—*contd.*
(Reference : Chapter V, Para 40)
Results of Re-weighment of Coal Wagons at various Loco Sheds by Railways at the Instance of the Expert Coal Committee
December, 1957

Serial No.	Date of check	Station	Average daily receipt of coal wagons		WAGONS RE-WEIGHED								NET RESULTS				Remarks
			No.	Weight	Total		With same weight		With over-weight		With under-weight		Percentage over-weight to average invoiced weight	Percentage under-weight to average invoiced weight	Percentage of net over-weight or under-weight to total weight of wagons		
					No.	Invoiced weight tons	No.	Weight	No.	Over-weight tons	No.	Underweight tons					
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
EASTERN RAILWAY—contd.																	
5	18-12-57	Howrah	14	308	33	742	1	20	14.90	12	6.80	3.42	2.42	1.09	..	..
6	25-12-57	Do.	..	..	10	223	..	6	2.05	4	1.35	1.56	1.47	.31	..	..
7	17-12-57	Bardel In.	6	132	10	233	..	2	1.65	8	9.50	3.68	5.00	..	3.36	..	
8	25-12-57	Do.	..	..	9	206	..	4	2.85	5	5.95	3.20	5.08	..	1.50	..
9	15-12-57	Barkakana	5	110	3	69	..	1	1.05	2	1.10	0.21	.22	..	.07	..	
10	22-12-57	Do.	..	..	6	135	..	3	1.15	3	.05	0.22	.20	.07	..	..
11	15-12-57	Pathardih	6	132	10	234	..	3	1.15	3	.20	0.21	.28	..	.02	..	
12	22-12-57	Do.	..	..	2	45	..	..	..	1	.05	..	.20	..	.11	..
13	18-12-57	Asansol	28	616	26	585	5	7	1.70	14	5.65	1.07	1.81	..	.69	..	
14	26-12-57	Do.	..	..	10	227	3	5	1.65	2	.15	1.47	.33	.66	..	..
15	17-12-57	On dal	17	374	7	162	2	5	.75	..	..	.65	..	.46	..	..
16	26-12-57	Do.	..	..	6	134	1	4	.45	1	.10	.49	.44	.26	..	..
17	18-12-57	Moghalsarai	39	858	12	222	..	..	..	12	1.25	..	.46	..	.46	..
18	15-12-57	Gaya	21	462	9	208	1	4	2.30	4	2.40	2.56	2.55	..	.05	..	
Total.			..	..	177	4,618	27	70	29.10	80	34.55	..	..	..	.11	..
NORTH EASTERN RAILWAY																	
1	20-12-57	Finsukhia	6	102	5	87	1	..	..	4	4.25	..	5.81	..	4.89	..
2	24-12-57	Do.	..	..	5	88	..	..	..	5	3.00	..	3.34	..	3.39	..
3	21-12-57	Bakarpur	5	85	11	184	1	5	5.25	5	4.10	7.58	4.95	.63	..	..
4	25-12-57	Mananji	5	85	13	206	2	..	..	11	4.15	..	2.44	..	2.01	..
Total.			..	..	34	565	1	5	5.25	25	15.50	..	..	..	1.81	..

APPENDIX II (b)—*contd.*
(Reference : Chapter V, Para 40)
Results of Re-weighments of Coal Wagons at various Loco Sheds by Railways at the Instance of the Expert Coal Committee
December, 1957

Serial No.	Date of check	Station	WAGONS RE WEIGHED					NET RESULTS					Remarks			
			Average daily receipt of coal wagons		Total			With same weight		With over weigh		Percentage over-weight to average invoiced weight		Percentage under-weight to average invoiced weight		
			No.	Weight	No.	Invoiced weight tons	No.	Weight	No.	Over-weight tons	No.	Under-weight tons		Percentage of net over weight or under-weight to total weight of wagons	Percentage of net over weight or under-weight to total weight of wagons	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
SOUTH EASTERN RAILWAY —contd.																
6	14-12-57	Bho Judih	8	176	6	144	..	4	1.25	2	2.00	1.30	4.18	..	.52	
7	20-12-57	Do.	..	..	6	136	..	3	5.25	3	1.50	7.88	2.17	2.76	..	
8	14-12-57	Khurda Rd.	12	264	12	273	1	10	8.85	1	0.50	3.87	2.41	3.06	..	
9	20-12-57	Do.	..	..	6	131	..	..	..	6	2.30	..	1.76	..	1.76	
10	14-12-57	Kharagpur	19	418	9	208	..	5	0.70	4	3.00	.61	3.22	..	1.11	
11	20-12-57	Do.	..	..	28	635	3	12	5.75	13	9.95	2.12	3.24	..	.65	
12	20-12-57	Do.	..	..	6	135	..	3	.65	3	2.25	.94	3.43	..	1.18	
13	14-12-57	Santragachi	14	308	13	283	..	5	1.55	8	3.75	1.38	2.19	..	.78	
14	16-12-57	Tatanagar	11	242	6	134	..	6	2.32	..	..	1.72	..	1.72	..	
15	17-12-57	Do.	..	..	9	201	2	4	3.84	3	4.30	4.31	6.40	..	.16	
TOTAL					151	3412	10	66	36.81	75	48.20	..	..	..	0.33	
WESTERN RAILWAY																
1	28-12-57	Shamgarh	9	198	34	771	1	29	14.10	4	1.25	2.10	1.36	1.66	..	
2	21-12-57	Do.	..	..	50	1,131	..	44	24.15	6	3.10	2.39	2.54	1.86	..	
3	22-12-57	Bandikui	7	154	4	95	..	..	..	4	10.95	..	11.58	..	11.58	
4	20-12-57	Baroda	18	396	17	396	..	7	1.85	10	7.95	1.13	3.43	..	1.54	
5	27-12-57	Do.	..	..	10	230	..	5	1.90	5	1.90	1.65	1.65	..	..
6	28-12-57	Godhra	11	242	2	46	..	2	0.40	..	..	0.86	..	0.86	..	
7	20-12-57	Kankaria	14	308	12	279	..	2	1.95	10	7.65	4.30	3.27	..	2.04	
8	27-12-57	Do.	..	..	16	367	..	..	..	16	4.05	..	1.10	..	1.10	
TOTAL					145	3,315	1	89	44.35	55	36.85	..	..	..	0.23	

APPENDIX II(b)—contd.
Results of Re-weighments of Coal Wagons at various Loco Sheds by Railways at the Instance of the Expert Coal Committee
December, 1957

Serial No.	Date of check	Station	Average daily receipt of coal wagons.			WAGONS RE-WEIGHED								NET RESULTS				
			No.	Weight	No.	Total		With over-weight		With under-weight		Percentage over-weight to average weight	Percentage under-weight to average weight	Percentage of net over-weight or under-weight of total-weight of wagons.	Remarks			
						No.	weight tons	No.	Over-weight tons	No.	Under-weight tons							
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17		
SOUTHERN RAILWAY																		
1	10-12-57	Basin Bridge	17	374	15	330	..	2	2.05	13	7.10	4.56	2.48	..	1.53			
2	17-12-57	Do.	..	..	7	153	..	..	..	7	3.30	..	2.16	..	2.16	
3	15-12-57	Arkoram	15½	341	8	184	..	5	.65	3	3.60	0.57	5.07	..	1.00			
4	22-12-57	Do.	..	..	12	260	..	..	..	12	8.75	..	3.37	..	3.37	
5	8-12-57	Sholanur.	4	88	6	136	..	1	.80	5	7.55	3.54	6.65	..	4.96			
6	16-12-57	Do.	..	..	5	110	..	2	2.30	3	5.45	5.56	8.00	..	2.87	
7	9-12-57	Erode	12	164	15	323	..	3	0.75	12	25.65	1.08	10.12	..	7.71			
8	17-12-57	Do.	..	..	20	456	1	7	6.25	12	13.55	3.96	4.90	..	1.60	
9	12-12-57	Shencottah	4½	72	6	97	..	..	..	6	2.40	..	2.50	..	2.50	
10	19-12-57	Do.	..	..	11	176	1	4	.90	6	1.00	1.36	1.08	..	.06	
11	10-12-57	Madura	9	144	9	98	1	5	.60	3	.55	1.08	1.64	..	.02			
12	25-12-57	Do.	..	..	21	259	..	13	16.40	8	4.60	10.41	4.54	4.56	..	
13	7-12-57	Bengalore(M.G.)	8	128	21	410	..	5	4.35	16	31.25	4.46	9.99	..	6.54			
14	13-12-57	Do.	..	..	9	190	..	1	1.10	8	6.80	5.23	4.01	..	2.99	
15	9-12-57	Do. (BG)	7	154	26	573	..	3	.90	23	36.25	1.41	7.29	..	6.33			
16	14-12-57	Do.	..	..	10	223	..	..	..	10	11.45	..	5.13	..	5.13	
17	8-12-57	Bezwa	16	352	27	611	1	10	3.15	16	16.30	1.35	4.31	..	2.15			
18	15-12-57	Do.	..	..	7	155	..	3	1.15	4	1.40	1.75	1.56	..	0.16	
19	11-12-57	Tinnevely	2	44	2	47	..	2	.60	..	..	1.29	..	1.29	..	
20	19-12-57	Do.	..	..	1	21	..	1	.20	..	..	0.94	..	0.94	..	

APPENDIX II (b)—contd.
(Reference : Chapter V, Para 40)
Results of Re-weighments of Coal Wagons at various Loco Sheds by Railways at the Instance of the Expert Coal Committee
December, 1957

December, 1957

Serial No.	Date of check	Station	Average daily receipt of coal wagons		WAGONS RE-WEIGHED						NET RESULTS							Remarks.
			No.	Weight	Total		With same weight		With over-weight		With under-weight		Percentage over-weight to average invoiced weight	Percentage under-weight to average invoiced weight	Percentage of net over-weight or under-weight to total weight of wagons			
					No.	Invoiced weight tons	No.	No.	No.	Over-weight tons	No.	Under-weight tons						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17		
SOUTHERN RAILWAY—contd.																		
21	7-12-57	Villupuram M.G.	10	160	17	267	17	17	3.20	..	..	1.19	..	1.19	..	..
22	13-12-57	Do.	..	..	15	252	..	11	3.35	4	1.40	1.79	2.17	.08	..	..
23	9-12-57	Trichinopoly M.G.	8	128	19	319	..	15	4.95	4	.75	2.00	.85	1.32	..	..
24	16-12-57	Do.	..	..	4	65	..	2	1.39	2	1.85	4.07	5.95	..	.69	..
25	17-12-57	Gadag (MG)	3	48	9	111	..	1	.15	8	2.95	1.71	2.87	..	2.51	..		
26	30-12-57	Do.	..	..	14	218	..	..	..	14	16.45	..	7.55	..	7.55	..
27	20-12-57	Miraj M.G.	5	80	13	180	..	..	..	13	7.50	..	4.17	..	4.17	..
28	10-12-57	Gooty	6	132	4	90	..	1	.05	3	.35	.23	.52	..	.33	..		
29	19-12-57	Do.	..	..	2	49	..	1	.10	1	.50	.42	2.00	..	.82	..
30	15-12-57	Guntakal M.G.	8	128	7	119	..	2	6.10	5	8.10	16.05	10.06	..	1.69	..		
Total					342	6,482	4	117	61.44	221	226.80				2.55			

APPENDIX II (b)—contd.
(Reference Chapter V, Para 40)
Results of Re-weighments of Coal Wagons at various Loco Sheds by Railways at the Instance of the Expert Coal Committee
January, 1958

Serial No.	Date of check	Station	Average daily receipt of coalwagons		WAGONS RE-WEIGHED								Percentage over-weight to average invoiced weight		NET RESULTS		
			Total		With same weight		With over-weight		With under-weight		Percentage over-weight to average invoiced weight	Percentage under-weight to average weight	Percentage of over-weight or under-weight to total weight of wagons				
			No.	Weight	No.	No.	No.	No.	Under-weight tons								
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		
NORTHERN RAILWAY																	
1	2-1-58	Lucknow	27	594	32	726.25	1	8	2.10	23	15.30	1.17	2.91	..	1.80		
2	7-1-58	Do.	..	..	22	490.50	1	5	9.78	16	5.95	9.06	1.65	0.80	..	
3	4-1-58	Amritsar	8	176	14	316.65	2	2	0.55	10	2.85	1.19	1.26	..	0.75		
4	5-1-58	Pathankot	2	44	4	87.00	..	4	2.73	..	..	3.14	..	3.14	..	
5	5-1-58	Ludhiana	10	220	6	136.35	..	1	0.25	5	1.25	1.07	1.11	..	0.73		
6	5-1-58	Khadanpura West	3	66	19	420.10	..	15	10.75	4	0.75	3.27	0.82	2.38	..		
7	7-1-58	Bainda	6	132	1	19.35	..	..	..	1	0.25	..	1.29	..	1.29	
8	8-1-58	Shahjahanpur (for Rusa Jn.)	6	132	17	380.20	..	12	3.95	5	3.75	1.50	3.23	0.05	..		
9	10-1-58	Do.	..	..	11	247.90	..	3	0.50	8	4.65	0.74	2.58	..	1.65	
10	11-1-58	Allahabad	13	286	17	386.45	..	13	3.85	4	0.96	1.30	1.06	0.75	..		
11	18-1-58	Lhakar Jn.	3	66	3	69.40	..	3	1.55	..	..	2.24	..	2.24	..	
12	20-1-58	Do.	..	..	3	71.40	..	2	0.85	1	0.20	1.75	0.84	0.91	..	
13	21-1-58	Do.	..	..	6	136.65	1	5	3.10	..	..	2.73	..	2.27	..	
14	21-1-58	Kanpur	22	484	19	429.95	..	..	..	19	20.15	..	4.68	..	4.68	
15	5-1-58	Jalhpur	11	242	5	114.35	..	4	4.48	1	1.20	4.91	5.17	2.87	..		
16	7-1-58	Do.	..	..	6	137.55	..	3	2.10	3	2.83	3.74	4.87	..	0.54	
17	8-1-58	Rewari	6	132	8	178.95	..	..	..	8	5.52	..	3.09	..	3.09	
18	24-1-58	Bainda	6	132	4	90.00	..	2	1.45	2	2.35	3.31	5.07	..	1.00		
TOTAL			197	4,439.00	5	82	47.99	110	67.96								0.45

APPENDIX II (b)—contd.
(Reference : Chapter V, Para 40)
Results of Re-weighments of Coal Wagons at various Loco Sheds by Railways at the Instance of the Expert Coal Committee
January, 1958

Serial No.	Date of check	Station	WAGONS RE-WEIGHED										NET RESULTS			
			Average daily receipt of coal wagons		Total		With same weight		With over-weight		With under-weight		Percentage over-weight to average invoiced weight		Percentage of over-weight or under-weight to total weight of wagons	
			No.	Weight	No.	Invoiced Weight tons	No.	No.	No.	Over-weight tons	No.	Under-weight tons	13	14	15	16
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
			NORTH EASTERN RAILWAY													
1	3-1-58	Mailani	5	85	6	66	1	..	..	5	1.85	..	3.27	..	..
2	3-1-58	Tinsukia	6	102	4	65	1	..	..	3	1.30	..	2.56	..	2.0
3	5-1-58	Do.	..	..	6	91	2	..	..	4	2.00	..	3.18	..	2.20
TOTAL			..	..	16	222	4	..	..	12	5.15	..	..	..	2.32
			SOUTH EASTERN RAILWAY													
1	2-1-58	Bilaspur	13	286	3	67	..	1	.30	2	2.50	1.67	5.13	..	3.30	
2	10-1-58	Do.	..	..	9	201	..	2	.25	7	3.80	.45	2.50	..	1.77
3	2-1-58	Adra	12	264	14	312	2	6	2.55	6	4.30	1.87	3.21	..	.56	
4	2-1-58	Bhojudih	8	176	6	142	..	..	..	6	3.50	..	2.46	..	2.46
5	10-1-58	Do.	..	..	5	112	..	..	..	5	3.55	..	3.16	..	3.16
6	2-1-58	Khurda Rd.	12	264	6	131	..	..	..	6	2.45	..	1.87	..	1.87
7	10-1-58	Do.	..	..	7	159	..	2	1.10	5	2.50	2.35	2.23	..	.88
8	2-1-58	Saibagachi	14	308	7	157	..	3	1.10	4	4.75	1.67	5.24	..	2.33	
9	2-1-58	Kharagpur	19	418	5	108	1	4	2.50	..	..	2.86	..	2.31	..
10	10-1-58	Do.	..	..	17	386	1	8	2.80	8	4.00	1.53	2.27	..	.31
11	10-1-58	Dongargarh	9	198	10	233	..	..	..	10	8.05	..	3.41	..	3.41
12	10-1-58	Tatanagar	11	242	5	113	1	4	.85	..	..	.75	..	.75	..
TOTAL			..	..	94	2,121	5	30	11.45	59	39.40	..	..	..	1.32

SOUTH EASTERN RAILWAY

APPENDIX 11 (b) (contd.)

(Reference: Chapter V, Para 40)

Results of Re-weighments of Coal Wagons at various Loco Sheds by Railways at the instance of the Expert Coal Committee
January, 1958

Serial No.	Date of check	Station	Wagons re-weighed										Percentage over-weight to average invoiced weight				NET RESULTS								
			Average daily receipt of coal wagons			With same weight			With over-weight				With under-weight				Percentage over-weight to average invoiced weight				Percentage of net over-weight or under-weight to total weight of wagons				
			Total		No.	With weight		No.	Over-weight tons		No.	Under-weight tons		No.	Invoiced weight		No.	Under-weight		No.	Invoiced weight		No.	Under-weight	
			No.	Weight		No.	Weight		No.	Weight		No.	Weight		No.	Weight		No.	Weight		No.	Weight		No.	Weight
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	+	-								
			SOUTHERN RAILWAY																						
1	4-1-58	Waltair	4½	99	5	110	2	0.40	3	1.35	0.93	2.01	0.86												
2	11-1-58	Do.	..	..	7	153	..	..	7	3.10	..	2.02	2.02								
3	3-1-58	Rajahmundry	13	286	15	342	3	1.30	5	1.40	0.83	1.23	0.03												
4	10-1-58	Do.	..	..	13	300	1	7.75	3	0.60	3.72	0.87	2.38										
5	9-1-58	Katpadi	2	44	4	90	..	..	4	4.05	..	4.49	4.49										
6	15-1-58	Do.	..	..	9	206	9	3.80	..	..	1.84	..	1.84								
7	4-1-58	Jalapet	11	242	20	449	3	1.50	17	15.10	2.16	3.99	3.03												
8	11-1-58	Do.	..	..	9	185	..	..	9	6.85	..	3.69	3.69								
9	1-1-58	Podanur	2	44	3	66	1	0.25	2	0.90	1.13	2.06	0.98												
10	8-1-58	Do.	..	..	3	67	1	..	2	5.05	..	9.27	7.48										
11	9-1-58	Coimbatore	2	44	4	72	..	1.30	2	1.80	3.66	4.99	0.69												
12	19-1-58	Do.	..	..	2	44	..	5.70	..	..	12.83	..	12.83								
13	7-1-58	Mayavaram	2	32	8	128	4	2.40	4	2.36	3.80	3.63	0.04												
14	13-1-58	Do.	..	..	8	134	..	1.05	3	1.10	1.27	2.11	0.04										
15	3-1-58	Tanjore	1½	24	6	107	1	1.96	2	0.80	3.69	2.22	1.11												
16	12-1-58	Do.	..	..	11	180	..	..	11	3.32	..	1.85	1.85								
17	3-1-58	Tinnevely	2	32	8	93	1	0.07	7	1.00	0.14	1.22	0.99												
18	9-1-58	Do.	..	..	7	92	..	0.45	5	0.92	1.59	1.46	0.52										
19	3-1-58	Quilon	2	32	5	59	1	0.27	4	4.26	2.19	9.16	6.77												
20	10-1-58	Do.	..	..	5	54	1	0.05	4	1.17	0.51	2.65	2.08										
21	6-1-58	Raichur	4½	99	3	69	..	..	3	5.65	..	8.14	8.14										
22	10-1-58	Do.	..	..	3	54	2	0.85	1	3.35	2.40	17.63	4.59										
TOTAL			158	3054	6	54	29.10	98	64.13	1.15	..	..	..									

APPENDIX II (b)—(concl.)
(Reference Chapter V, Para 40)
Results of Re-weighments of Coal Wagons at various Loco Sheds by Railways at the instance of the Expert Coal Committee,
January 1958

Serial No.	Date of check	Station	Wagons Re-weighed						Percentage			NET RESULTS			
			Average daily receipt of coal wagons		Total		With same weight		With over weight		Over-weight to average invoiced weight		Under-weight to average invoiced weight		Percentage of over-weight or under-weight to total weight of Wagons
			No.	Weight	No.	Invoiced weight tons	No.	Weight	No.	Weight tons	Weight to average invoiced weight	Weight to average invoiced weight	Weight to average invoiced weight	Weight to average invoiced weight	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
WESTERN RAILWAY															
1	9-1-58	Godhra	11	242	7	162	..	4	75	3	55	0.82	78	0.12	..
2	3-1-58	Shamgarh	9	198	2	43	..	2	1.80	..	..	4.12	..	4.12	..
3	13-1-58	Do.	..	..	14	315	..	8	2.10	6	1.65	1.14	1.27	0.11	..
4	3-1-58	Baroda	18	396	16	368	1	8	3.95	7	4.35	2.22	2.63	..	0.11
5	9-1-58	Do.	..	..	2	47	..	..	..	2	1.40	..	3.0	..	3.00
6	2-1-58	Udhna	6	132	4	89	..	..	..	4	3.00	..	3.38	..	3.38
7	2-1-58	Kankaria	14	308	1	20	..	..	..	1	0.10	..	0.50	..	0.50
8	9-1-58	Do.	..	..	2	46	..	..	..	2	1.60	..	3.50	..	3.50
		TOTAL			48	1090	1	22	8.60	25	12.65				0.37
CENTRAL RAILWAY,															
1	5-1-58	Jhansi	19	418	8	175	1	..	..	7	3.05	..	1.92	..	1.74
2	4-1-58	Dhond	9	198	30	700	5	12	3.15	13	7.80	1.11	2.22	..	0.67
3	5-1-58	Do.	..	..	23	545	4	6	1.85	13	4.45	1.31	1.11	..	0.48
4	11-1-58	Shahabad	6	132	7	161	..	..	..	7	4.70	..	2.99	..	2.99
5	12-1-58	Do.	..	..	6	138	..	..	..	6	4.05	..	2.92	..	2.92
		TOTAL	..		74	1719	10	18	4.95	46	24.05				1.11

APPENDIX 13
(Reference: Chapter V, Para 45)

Summary of the Results of the Service Trials conducted at certain sheds on Railways on Mail & Express, Passenger and Goods Services, showing the difference between trip ratios and the actual consumption.

Railway Shed	Consumption recorded by sheds for the same engines & services during 3 months prior to trials against trip ration quantity.										Net Percentage variation (Col. 11—Col. 6).	
	Trials by Expert Coal Committee					Percentage variation Col. 5 to Col. 3 (+) Excess (—) Saving					Percentage variation to Col. 8 (+) Excess (—) Saving	
	No. of trips	Trip ration quantity	Consumption during trials	Difference (+) Excess (—) Saving	No. of trips	Trip ration Quantity	Recorded consumption	Difference (+) Excess (—) Saving	Percentage variation to Col. 8 (+) Excess (—) Saving			
	2	3	4	5	6	7	8	9	10	11	12	
MAIL EXPRESS AND PASSENGER :—												
<i>Broad-Gauge</i>												
Northern (Lucknow)	8	47—5	46—14	(—) 9—11	(—) 11·2	73	454—15	485—0	(+) 30—5	(+) 6·7	(+) 7·9	
Eastern (Asansol)	10	45—18	50—17	(—) 5—19	(+) 11·9	50	255—5	284—15	(+) 29—10	(+) 11·6	(+) 9·7	
S. Eastern (Kharagpur)	8	35—8	34—17	(—) 9—11	(—) 11·6	24	95—10	106—0	(+) 11—0	(+) 6·5	(+) 8·1	
Central (Bhusawal)	16	83—0	85—2	(+) 2—2	(—) 7·3	58	357—10	358—15	(+) 1—5	(+) 11·5	(+) 4·2	
<i>Metre-Gauge</i>												
Western (Bandikui)	16	46—16	44—8	(—) 2—8	(—) 5·1	60	181—17	283—16	(+) 2—4	(+) 11·2	(+) 6·3	
Southern (Villupuram)	16	63—6	59—8	(—) 3—18	(—) 6·2	32	126—12	135—6	(+) 8—14	(+) 6·9	(+) 13·1	
Central (Secunderabad—Lallaguda)	8	35—7	34—15	(—) 1—12	(—) 11·7	76	304—2	325—7	(+) 21—5	(+) 7·0	(+) 8·7	
N. Eastern (Bareilly City)	16	27—12	22—5½	(—) 5—6½	(—) 19·3	80	138—0	137—9	(—) 1—11	(—) 0·4	(+) 18·9	
GOODS :—												
<i>Broad Gauge</i>												
Northern (Lucknow)	10	60—10	61—2	(+) 1—12	(+) 11·0	98	604—15	648—0	(+) 43—5	(+) 7·2	(+) 6·2	
Eastern (Asansol)	6	41—5	44—10	(+) 3—5	(+) 7·8	46	207—2	241—15	(+) 34—13	(+) 16·7	(+) 8·9	
Central (Secunderabad—Lallaguda)	8	40—3	39—13	(—) 1—10	(—) 11·2	44	197—4	210—15	(+) 13—11	(+) 6·8	(+) 8·0	
<i>Metre Gauge</i>												
Western (Bandikui)	8	25—4	23—6	(—) 1—18	(—) 7·5	20	68—12	68—12	..	..	(+) 7·5	
Southern (Villupuram)	8	30—0	30—4	(+) 0—4	(+) 0·7	12	45—5	52—1	(+) 6—16	(+) 15·0	(+) 14·3	
Central (Secunderabad—Lallaguda)	4	17—1	17—18	(+) 0—17	(+) 4·7	21	87—14	107—13	(—) 19—19	(+) 20·2	(+) 15·5	
N. Eastern (Bareilly City)	8	31—18	31—1	(—) 0—17	(—) 2·7	48	139—4	147—5	(+) 8—1	(+) 5·8	(+) 8·5	

APPENDIX No. 13 (contd.)
(Reference : Chapter V Para 45)

Details of the Service Trials conducted at certain sheds on Railways on Mail and Express, Passenger and Goods Services, showing the difference between trip ratios and the actual consumption

BROAD GAUGE

Service	Engine No.	Section	Trials by Expert Coal Committee				Consumption recorded by shed for the same engines and services during 3 months prior to trials against trip ration quantity					Net percentage variation col. (11) to col. (7)
			No. of trips during trials	Total trip ratios for trial trips	Total consumption during trials	Percentage of variations of col. (6) to col. (5)	Total No. of trips	Total trip ratios quantity	Recorded consumption	Percentage of variation of col. (10) to col. (9)		
I	2	3	4	5	6	7	8	9	10	11	12	
				T.—C	T.—C		T.—C	T.—C	T.—C			
LUCKNOW (NORTHERN RAILWAY)												
Express	7593 WP	Lucknow-Moghal-sarai.	2	14 5	13 18	-2.5	38	259 0	274 10	+6.0	..	
Do.	7235 WP	Do.	2	14 10	14 16	+2.1	14	95 15	101 0	+5.5	..	
Passenger	2875 MPS	Lucknow-Allahabad.	2	9 10	8 17	-5.8	18	84 15	92 0	+8.5	..	
Do.	2867 MPS	Do.	2	9 0	9 3	+1.7	3	15 5	17 10	+14.7	..	
TOTAL FOR EXPRESS/ PASSENGER Through Goods.	8794 WG	Lucknow-Pratabgarh.	2	47 5	46 14	-1.2	27	454 15	485 0	+6.7	+7.9	
Do.	8732	Do.	4	25 15	27 8	-6.4	26	177 10	194 5	+9.4	..	
Pick-Up Goods	5903 AWD	Lucknow-Faizabad	2	11 0	10 4	-7.2	6	33 0	35 10	+7.5	..	
Do.	5799 "	Do.	2	11 0	11 8	+3.6	39	214 10	227 10	+6.1	..	
TOTAL FOR GOODS SERVICES				60 10	61 2	+1.0		604 15	648 0	+7.2	+6.2	
TOTAL FOR ALL SERVICES			18	107 15	107 16	+0.1	171	1059 10	1133 0	+6.9	+6.8	
ASANSOL (EASTERN RAILWAY)												
Express	7274 WP	Asansol-Howrah	4	17 16	18 15	-5.3	10	48 15	52 15	+8.2	..	
Do.	7232 WP	Do.	2	8 18	9 10	-6.7	12	52 10	59 15	+13.8	..	
Passenger	7247 WP	Asansol-Jhajha	2	11 12	11 2	-4.3	16	88 0	95 5	+11.6	..	
Do.	7232 WP	Do.	2	11 12	11 10	-0.8	12	66 0	77 0	+16.6	..	
TOTAL FOR EXPR SS/ PASSENGER				49 18	50 17	+1.9		255 5	284 15	+11.6	+9.7	

Note : (+) indicates excess.
(-) indicates saving.

APPENDIX 13 (contd.)
(Reference : Chapter V, Para 45)

BROAD GAUGE

Details of the Service Trials conducted at certain sheds on Railways on Mail and Express, Passenger and Goods Services, showing the difference between trip rations and the actual consumption

Service		Engine No.	Section	Trials by Expert Coal Committee					Consumption recorded by shed for the same engines and services during 3 months prior to trials against trip ration quantity					Net Percentage variation col. (11) — col. (7)
				No. of trips during trials	Total trip rations for trial trips	Total consumption during trials	Percentage of variation of col. (6) to col. (5)	Total No. of trips	Total trip rations quantity	Recorded consumption	Percentage of variation of col. 10 to col. 9			
I		2	3	4	5	6	7	8	9	10	11	12		
ASANSOL (EASTERN RAILWAY) — (contd.)														
Thorough Goods	8783 WG		Asansol-Chitpur Docks	4	28 0	30 14	-9.8	16	87 15	105 0	+19.6			
"	8721		"	2	13 5	13 16	-4.2	30	119 "	136 15	+14.6			
Total for Thorough Goods					41 5	44 10	-7.8		207 2	241 15	+16.7		+8.9	
TOTAL FOR ALL SERVICES				16	91 3	95 7	-4.6	96	462 7	526 10	+13.9		-5.5	
KHARAGPUR (SOUTH EASTERN RAILWAY)														
Express	7328 WP		Kharagpur-Khurda Road	2	11 10	11 5	-1.8	7	37 0	42 0	+13.5			
"	7371 WP		"	2	12 0	12 10	-4.2	4	22 5	24 10	+12.3			
Passenger	7316 WP		Kharagpur-Howrah	2	6 13	5 12	-9.0	3	9 15	9 5	-5.2			
"	7318 WP		"	2	5 15	5 10	-4.3	10	30 10	30 5	-0.8		-8.1	
TOTAL FOR EXPRESS/PASSENGER				8	35 8	34 17	-1.6	24	99 10	106 0	+6.5			
BHUSAWAL (CENTRAL RAILWAY).														
Mail Express	7527 WP		Bhusawal-Igatpuri	4	10 0	20 14	-8.9	12	57 10	66 15	+16.0			
"	7422 WP		"	4	18 0	19 8	-7.7	12	103 10	112 0	+8.2			
Passenger	1505 D5		Bhusawal-Igatpuri	4	23 0	24 18	-8.2	20	115 10	126 15	+9.7			
"	1518 D5		"	4	23 0	24 2	-4.7	14	81 0	93 5	+15.1			
TOTAL FOR MAIL EXPRESS/PASSENGER				16	83 0	89 2	-7.3	58	357 10	398 15	+11.5		+4.2	
SECUNDERABAD LALAGUDA (CENTRAL RAILWAY).														
Thorough Goods	9556 WG		Secunderabad-Kazipet Junction	4	19 6	18 6	-5.2	30	136 13	142 0	+3.9			
"	8894 WG		"	4	20 17	21 7	-2.4	14	60 11	68 15	+13.5			
TOTAL FOR THROUGH GOODS				8	40 3	39 13	-1.2	44	197 4	210 15	+6.8		+8.0	

NOTE : (.) indicates excess.
(-) indicates saving.

APPENDIX No. 13.(contd.)

(Reference: Chapter V, Para 45)

Details of the Service Trials conducted at certain sheds on Railways on Mail and Express, Passenger and Goods services showing the difference between trip rations and the actual consumption

METRE GAUGE

Service	Engine No.	Section	Trials by Expert Coal Committee			Consumption recorded by sheds for the same engines during 3 months prior to trials against trip ration quantity					
			No. of trips during trials	Total trip ration for trial trips	Total consumption during trials	Percentage of variation of col. (6) to col. (5)	Total No. of trips	Total Trip ration quantity	Recorded consumption	Percentage of variation col. (10) to col. (9)	Net percentage variation col. (11) col. (7).
I	2	3	4	5	6	7	8	9	10	11	12
BANDIKUI (WESTERN RAILWAY) T-C											
Mail/Express	2130 YP	Bandikui-Delhi	4	13 16	13 15	-0.4	22	76 8	76 8	..	
"	2198 YP	"	4	13 16	13 15	-0.4	14	49 4	51 16	+5.3	
Passenger	1962 YP	Bandikui-Phulera Junction.	4	9 12	9 0	-6.3	18	42 0	41 12	-1.0	
"	2199 YP	"	4	9 12	7 18	-17.7	6	14 0	14 0	.	
TOTAL FOR MAIL/EXPRESS/PASSENGER											
Through Goods	4159 YG	Bandikui-Phulera Junction.	4	12 12	10 11	-12.1	12	40 8	40 8	..	+6.3
"	2501 YG	"	4	13 14	12 15	-3.4	8	28 4	28 4	..	
Total for through Goods				25 4	23 6	-7.5		68 12	68 12	..	+7.5
TOTAL FOR ALL SERVICES			24	72 0	67 14	-6.0	80	250 4	252 8	+0.9	+6.9
VILLUPURAM (SOUTHERN RAILWAY)											
Express	2390 YP	(Madras) Egmore-Trichinopoly.	4	20 13	16 10	-20.1	4	20 13	21 8	+3.6	
"	2182 YP	"	4	20 13	18 16	-9.0	12	61 19	66 17½	+7.9	
Passenger	2062 YP	Villupuram-Trichinopoly.	4	11 0	11 11	+5.0	8	22 0	22 9½	+2.2	
"	2047 YP	"	4	11 0	12 11	+14.1	8	22 0	24 11	+11.6	
TOTAL FOR EXPRESS/PASSENGER											
Through Goods	4287 YG	Villupuram-Trichy Goodsyards	4	14 14	14 2	-4.1	4	14 14	16 17	+14.6	+13.1
"	2607 YG	"	4	15 6	16 2	+5.2	8	30 11	35 4	+15.23	
TOTAL FOR THROUGH GOODS				30 0	30 4	+0.7		45 5	52 1	+15.0	+14.4
TOTAL FOR ALL SERVICES			24	93 6	89 12	-4.0	44	171 17	187 7	+9.0	+13.0

NOTE: (+) indicates excess.
(-) indicates savings.

APPENDIX No. 13 (*concl.d.*)
(Reference: Chapter V, Para 45)

Details of the Service Trials conducted at cartain sheds on Railways on Mail and Express, Passenger and Goods services showing the difference between trip rations and the actual consumption

Service	Engine No.	Section	Trials by Expert Coal Committee					Consumption recorded by sheds for the same engines and services during 3 months prior to trials against trip ration quantity				Net percentage variation col. (11)—col. (7)
			No. of trips during trials	Total trip ration for trial trips	Total consumption during trials	Percentage of variation of col. (6) to col. (5).	Total No. trips	T to ta trip ration quantity	Recorded Consumption	Percentage of variation of col. (10) to col. (9)		
I	2	3	4	5	6	7	8	9	10	11	12	
				T.—C	T.—C			T.—C	T.—C			
				SECUNDERABAD LALLAGUDA (CENTRAL RAILWAY)								
Express	173 YB	Secunderabad-Dronachallam.	2	7 8	7 5	—2.0	26	96 0	104 18	+9.3		
"	177 YB	"	2	7 8	7 11	+1.9	22	78 18	86 18	+10.1		
Passenger	2029 YB	Secunderabad-Purna.	2	11 5	11 11	2.9	11	51 0	52 8	+2.7		
"	2095 YP	"	2	9 6	8 8	—4.3	17	78 4	81 3	+3.7		
TOTAL FOR EXPRESS/PASSENGER				35 7	34 15	—1.7		304 2	325 7	+7.0	—8.7	
Goods	4075 YG	Secunderabad-Nizamabad.	2	9 4	9 14	5.1	10	44 1	49 10	+12.3		
"	4072 YG	"	2	7 17	8 4	+4.2	11	43 13	58 3	+33.2		
TOTAL FOR GOODS SERVICES				17 1	17 18	+4.7		87 14	107 13	+20.2	—15.5	
TOTAL FOR ALL SERVICES			12	52 8	52 13	+0.5	97	391 16	433 0	+10.5	10.0	
				BAREILLY CITY (NORTH EASTERN RAILWAY)								
Express	1012 YB	Bareilly City-Kathgodam.	4	6 18	5 10	—20.3	18	31 1	32 10	+4.7		
"	1021 YB	"	4	6 18	5 10	—20.3	42	72 9	74 18	+3.4		
Passenger	1023 YB	Bareilly City-Kasganj.	4	6 18	4 14½	—31.9	4	6 18	5 19	—12.8		
"	1028 YB	"	4	6 18	6 11	—5.1	16	27 12	24 2	—12.7		
TOTAL FOR EXPRESS/PASSENGER				27 12	22 5½	—19.3		138 0	137 9	—0.4	+18.9	
Through Goods	4057 YG	Bareilly City-Maunani.	4	16 14	15 14	—6.0	8	23 4	22 12	—2.6		
"	2552 YG	"	4	15 4	15 7	+1.0	40	116 0	124 13	+7.5		
TOTAL FOR THROUGH GOODS SERVICE				31 18	31 1	—2.7		139 4	14 5	+5.8	+8.5	
TOTAL FOR ALL SERVICES			24	59 10	53 6½	—10.4	128	277 4	+	+	+13.1	

NOTE: (+) indicates excess.
(—) indicates saving.

APPENDIX 14
(Reference : Chapter VI, Para 60)
Statement showing the Cost of Handling and Sale Proceeds of Ashes and Cinders.
(Based on the year 1956-57)

Railway	Approximate output of cinders	Costs of present working			Anticipated Dep't. costs against Col. (3)	Extra expenditure involved. Col. (6)-(3)	Quantity of cinders sold to Rly. employees	Sale proceeds of cinders	Sale proceeds of ashes	Total monetary return Col. (9) + (10)	Remarks
		Under contract	Under Departmental	Total							
(1)	Tons (2)	Rs. (3)	Rs. (4)	Rs. (5)	Rs. (6)	Rs. (7)	Tons (8)	Rs. (9)	Rs. (10)	Rs. (11)	(12)
Central	36	14	2.15	2.29	93	79	11	1.60	11.38	12.98	On Jhansi, Bhusaval, Jabalpur and Nagpur divisions the entire work is done departmentally. On Bombay, Sholapur and Secunderabad divisions Contract System is in force.
Eastern	26	4.80	..	4.80	15.79	10.99	14	1.48	27	1.75	On this Railway the entire work is done under contract. The Railway pays to the contractors for removal of ashes from ash pits, picking of cinders and removal of ashes to nominated sites. In addition the Railway allows the contractor to sell the picked cinders to the Railway staff and retain the proceeds of sale.
Northern	31	2.06	3.12	5.18	13.02	10.96	24	3.85	1.47	5.32 *2.11	On the Ex. E. I. portion of the Northern Railway (Allanabad, Lucknow, and Moradabad divisions) where the entire work is done under contract, contractors pay to the Railway in lump sum and retain the proceeds of sale of cinders to railway staff. In the case of Bikaner division the contractor offered Rs. 2,11,000 to the railway during 1956-57 towards the purchase of cinders and ashes combined.
North Eastern	9	1.90	..	1.90	3.80	1.90	6	77	..	77	On this Railway the entire work is done under contract and the system is similar to that on the Eastern Railway. The Railway did not furnish approximate costs under Column (6) and an approximate figure has been adopted to arrive at the all Rly. figure.
South Eastern	37	5.06	28	5.34	7.70	2.64	11	1.70	5	1.75	Contract system is in force on this Railway, but the sale of cinders to railway staff is undertaken departmentally. The figures are based on the revised system introduced during 1957.
Southern	32	..	9.71	9.71	..	..	1	23	10.44	10.67	On this Railway the entire work is done departmentally.
Western	18	2.20	..	2.20	7.49	5.29	1	29	19.97	20.26	Contract system is in force on this Railway, but the sale of cinders to Railway staff is undertaken departmentally.
	189	16.16	15.26	31.42	48.73	32.57	68	9.92	43.58	53.50+2.11*	

*For Bikaner Division.

PART I
APPENDIX 15
(Reference: Chapter VII, Para 64 & 65)

Statement showing the quantities of Coal carried by sea and rail route from Bengal and Bihar Coalfields as well as from the Outlying fields and freight paid thereon by Southern Railway.

Bengal and Bihar Coalfields

NOTE—Quantities shown below as per invoiced weight

Bengal and Bihar Coalfields															
Year	Grade of coal	Receipts in thousands of tons from Bengal and Bihar Coalfields				Freight paid in Rupees.				(Figure in thousands.)					
		By rail route		By rail- <i>cum</i> sea route	Total	Sea freight	Rail freight on sea borne coal	Total rail freight on rail borne coal	Total rail freight (col. 7 + 9)	Grand total (col. 8 + 9)	Freight per ton of sea borne coal		Freight per ton on rail-borne coal		Over all freight per ton.
		3	4								5	6	7	8		9	10	11	12	13	14
1954-55	Sel. A														
	Sel. B	62	871	933	24,799	11,650	36,449	1,535	12,185	37,984					
	Gr. I														
	Non-loco . . .	10	20	30	570	267	837	247	514	1,084					
	TOTAL	72	891	963	25,369	11,917	37,286	1,782	13,699	39,068	41.85	24.75			40.57
1955-56	Sel. A														
	Sel. B	327	899	1,226	26,188	11,912	38,100	7,043	18,955	45,143					
	Gr. I														
	Non-loco . . .	15	30	45	748	397	1,145	323	720	1,468					
	TOTAL	342	929	1,271	26,936	12,309	39,245	7,366	19,675	46,611	42.24	21.53			36.67
1956-57	Sel. A														
	Sel. B	359	771	1,130	25,077	9,791	34,868	8,616	18,407	43,484					
	Gr. I														
	Non-loco . . .	16	26	42	865	330	1,195	344	674	1,539					
	TOTAL	375	797	1,172	25,942	10,121	36,063	8,960	19,081	45,023	45.25	23.89			38.42

PART I
APPENDIX 15—(contd.)
(Reference: Chapter VII, Para 64 & 65)
SOUTHERN RAILWAY

Statement showing the Quantities of coal carried by sea and rail route from the Bengal and Bihar Coalfields as well as from the Outlying Fields and freight paid thereon by Southern Railway.
(Figures in thousands)

Quantities supplied by rail route from outlying fields to different Divisions and the freight paid													
Year	Receiving Divisions	Central India		Singareni (Andhra)		Talcher (Orissa)		Other Fields		TOTAL		GRAND TOTAL	
		Qty.	Freight	Qty.	Freight	Qty.	Freight	Qty.	Freight	Qty.	Freight	Qty.	Freight
1954-55	Hubli .	37	717	..	..	..	..	..	..	37	717	..	..
	Hubli .	..	..	..	..	..	..	..	..	..	..	..	..
	Guntakal	..	..	414	4608	..	..	..	..	414	4608	576	7013
	Mysore	..	..	..	..	..	..	..	..	..	..	..	..
	Bezwada	..	..	..	..	125	1688	..	..	125	1688	..	17
1955-56	Hubli .	106	2602	..	..	..	..	..	..	106	2602	..	..
	Hubli .	..	..	..	..	..	..	..	..	..	..	..	..
	Guntakal	..	..	353	4394	..	..	..	..	353	4394	604	9069
	Mysore	..	..	..	..	..	..	..	..	..	..	..	..
	Bezwada	..	..	..	..	145	2073	..	..	145	2073	..	01
1956-57	Hubli .	135	3479	..	..	..	..	..	..	135	3479	..	..
	Hubli .	..	..	..	..	..	..	..	..	..	..	..	..
	Guntakal	..	..	366	4524	..	..	..	..	366	4524	648	10032
	Mysore	..	..	..	..	..	..	..	..	..	..	..	..
	Bezwada	..	..	..	..	147	2029	..	..	147	2029	..	48

PART II

APPENDIX 15—(contd.)

(Reference: Chapter VII, Para 64 & 65)

SOUTHERN RAILWAY

Statement showing pilferage and handling losses on Sea-borne Coal.

(figures in thousands)

Losses on journey from loading docks to receiving docks.												Losses on journey from receiving docks to sheds.											
Year	Receiving Docks	Invoiced quantity in tons as per Bill of lading prepared at loading Docks	Quantity on actual weight at receiving docks	Difference—loss on the journey		Receiving Shed	Invoiced quantity	Quantity on actual weight	Difference—losses on the journey		Percentage of losses from colliery to shed												
				Quantity	Percentage of invoiced quantity				Quantity	Percentage of invoiced quantity													
												Tons	Tons.	Tons	Tons								
I	2	3	4	5	6	7	8	9	10	11	12												
1955-56	Madras	339	335	4	1.2	Pattabiram	2.0	1.9	0.1	5.0													
	Cuddalore	194	184	10	5.1	Arkonam	13.6	13.5	0.1	0.7													
	Tuticorin	162	159	3	1.8	Walajah Road	2.2	2.1	0.1	4.5													
	Cochin	233	229	4	1.7	Katpadi	2.1	2.1	..	..											
						Jalarpet	22.5	22.3	0.2	0.9													
						Bowringpet	0.6	0.6	..	..											
						Pakala	2.1	2.1	..	..											
						Bangalore Cantt.	6.9	6.7	0.2	2.9													
						Bangalore (City) M.G.	3.1	3.0	0.1	3.2													
						Kolar	0.3	0.3	..	..											
					Araikere	1.2	1.2	..	..												
					Shimoga Town	1.3	1.3	..	..												
					Harihar	0.9	0.9	..	..												
	TOTAL	928	907	21	2.2		58.8	58.0	0.8	1.4	3.6												

PART II

APPENDIX 15—(concl'd.)
Reference: Chapter VII, Para 64 & 65

SOUTHERN RAILWAY

(Figures in thousands.)

Statement showing pilferage and handling losses on Sea-borne Coal

Losses on journey from receiving docks to sheds.											
Losses on journey from leading docks to receiving docks.											
Year	Receiving Docks	Invoiced quantity in tons as per Bill of lading prepared at loading Docks.	Quantity on actual weight at receiving docks	Differences—loss on the journey.		Receiving Shed	Invoiced quantity		Quantity on actual weight	Difference — losses on the journey	
				Tons	Percentage of invoiced quantity		Tons			Quantity	Percentage of invoiced quantity
1	2	3	4	5	6	7	8	9	10	11	12
1956-57	Madras	290	289	1	0.3	Pattabiram	2.4	2.3	0.1	4	
	Cuddalore	164	160	4	2.4	Arkonam	17.5	17.4	0.1	0.6	
	Tuticorin	136	133	3	2.2	Walajah Road	2.1	2.1			
	Cochin	216	212	4	1.8	Katpadi	1.8	1.8			
						Jalarpet	20.1	20.1			
						Bowringpet	0.2	0.2			
						Pakala	2.7	2.7			
						Bangalore Cantt	8.2	7.6	0.6	7	
						Bangalore City (M.G.)	4.9	4.8	0.1	2	
						Kolar	0.8	0.8			
						Araikere	2.5	2.4	0.1	4	
						Shimoga Town	1.0	1.0			
						Harihar	1.3	1.2	0.1	8	
	TOTAL	806	794	12	1.5		65.5	64.4	1.1	1.7	3.2

Note 1.—Weightment of all wagons after loading coal from steamers is done on weigh-bridge at the ports of landing.

2. The higher % of shortages at Cuddalore and Tuticorin ports are due to coal being discharged in mid stream into lighters and then brought to wharf for loading into wagons.

(Reference: Chapter VIII, Para 74)

Total number of complaints lodged by railway to the coal controller regarding defective supplies of coal and number of complaints that were outstanding on 1st April 1955, 1st April 1956 and 1st April 1957.

Railway	1954-55					1955-56					1956-57						
	No. of comp-laints lodged to the coal control-ler	No. of Wagons involved	No. of comp-laints on which action was taken by Coal Con-troller	No. of wagons involved	No. of comp-laints lodged to the Coal Control-ler	No. of comp-laints on which action was taken by Coal Con-troller	No. of wagons involved	No. of complaints out-standing	No. of wagons involved	No. of complaint lodged to the Coal Controller	No. of wagons involved	No. of complaints on which action was taken by Coal Controller	No. of complaints out-standing	No. of wagons involved			
Western	1	2	..	1	2	42	43	40	40	2	3	145	191	141	187	4	4
Central	115	259	59	56	145	221	574	116	254	105	320	163	345	65	131	98	2,14
Northern	123	509	102	21	117	452	1,630	284	921	168	709	731	2,088	313	777	418	1,311
Southern Eastern	137	351	44	93	204	122	425	38	243	84	182	127	656	37	206	90	4,50
Eastern	350	569	280	70	311	475	1811	308	1,047	167	764	485	1,920	319	1,232	166	6,88
Southern	11	33	2	9	24	16	72	..	..	16	72	24	122	6	30	29	92
										*22	*708	*11	*708	*11	204		*5,04
North-Eastern	10	45	6	4	31	10	82	2	3	8	79	9	94	1	3	8	91
TOTAL	747	1,768	493	1,085	683	1,338	4,637	788	2,508	550	2,129	1,706	6,124	893	2,770	813	3,354

Quantities shown against () relate to high percentage of dust and smalls from August 1956 to April 1957.

APPENDIX 17

(Reference: Chapter VIII, Para 75)

SHED SERVICES REGISTER

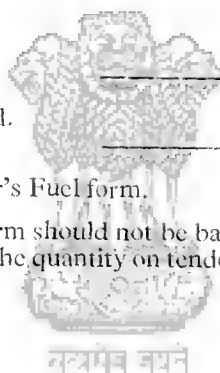
Engine No.	Type	Date	Period Hrs. Min.	*Consumption as per ready reckoner.
------------	------	------	---------------------	-------------------------------------------

- (1) Arrival incoming pit.
- (2) Arrival coal stage.
- (3) Arrival on repair or service line.
- (4) Total shed movement (including shunting).
- (5) Shunting duty if any.
 Time commenced.
 Time completed.
- (6) Period shed movement excluding shunting (4)-(5).
- (7) Period 'banked fire' to full steam pressure.
 (a) Time commenced
 (b) Time Completed.
- OR
- Period 'lighting up' to full steam pressure.
 (a) Time commenced
 (b) Time completed
- (8) Departure from Shed.
- (9) Hours standing in steam.
 (8)-(7b).

*Total shed consumption by time record.

@Total shed consumption as per Driver's Fuel form.

N.B. @The shed consumption shown in this form should not be based on fixed allowance but should be worked out by actual difference between the quantity on tender when leaving the coal stage and the quantity on tender when leaving the shed.



APPENDIX 18

(Reference: Chapter VIII, Para 75)

**READY RECKONER FOR COAL CONSUMPTION
(SHED MOVEMENTS—LB.)****I****LOCOMOTIVE GROUP GRATE AREAS**

Time Hours							Upto 20 sq. ft.	21 sq. ft. to 30 sq. ft.	31 sq. ft. to 40 sq. ft.	41 sq. ft. to 50 sq. ft.	51 sq. ft. and above
0.0	.	.	.	.	.	.	0	0	0	0	0
1.1	.	.	.	.	.	.	22	37	52	67	82
1.2	.	.	.	.	.	.	45	75	105	135	165
1.3	.	.	.	.	.	.	67	112	157	202	247
1.4	.	.	.	.	.	.	90	150	210	270	330
1.0	.	.	.	.	.	.
1.1	.	.	.	.	.	.	112	187	262	337	412
1.2	.	.	.	.	.	.	135	225	315	405	495
1.3	.	.	.	.	.	.	157	262	367	472	577
1.4	.	.	.	.	.	.	180	300	420	540	660
2.0	.	.	.	.	.	.
2.1	.	.	.	.	.	.	202	337	472	607	742
2.2	.	.	.	.	.	.	225	375	525	675	825
2.3	.	.	.	.	.	.	247	412	577	742	907
2.4	.	.	.	.	.	.	270	450	630	810	990
3.0	.	.	.	.	.	.
3.1	.	.	.	.	.	.	292	487	682	877	1072
3.2	.	.	.	.	.	.	315	525	735	945	1155
3.3	.	.	.	.	.	.	337	562	787	1012	1237
3.4	.	.	.	.	.	.	360	600	840	1080	1320
4.0	.	.	.	.	.	.
4.1	.	.	.	.	.	.	382	637	892	1147	1402
4.2	.	.	.	.	.	.	405	675	945	1215	1485
4.3	.	.	.	.	.	.	427	712	997	1282	1567
4.4	.	.	.	.	.	.	450	750	1050	1350	1650
5.0	.	.	.	.	.	.
5.1	.	.	.	.	.	.	472	787	1102	1417	1732
5.2	.	.	.	.	.	.	495	825	1155	1485	1815
5.3	.	.	.	.	.	.	517	862	1207	1552	1897
5.4	.	.	.	.	.	.	540	900	1260	1620	1980
6.0	.	.	.	.	.	.
6.1	.	.	.	.	.	.	562	937	1312	1687	2062
6.2	.	.	.	.	.	.	585	975	1365	1755	2145
6.3	.	.	.	.	.	.	607	1012	1417	1822	2227
6.4	.	.	.	.	.	.	630	1050	1470	1890	2310
7.0	.	.	.	.	.	.
7.1	.	.	.	.	.	.	652	1087	1522	1957	2392
7.2	.	.	.	.	.	.	675	1125	1575	2025	2475
7.3	.	.	.	.	.	.	697	1162	1627	2092	2557
7.4	.	.	.	.	.	.	720	1200	1680	2160	2640
8.0	.	.	.	.	.	.
8.1	.	.	.	.	.	.	742	1237	1732	2227	2722
8.2	.	.	.	.	.	.	765	1275	1785	2295	2805
8.3	.	.	.	.	.	.	787	1312	1837	2362	2887
8.4	.	.	.	.	.	.	810	1350	1890	2430	2970
9.0	.	.	.	.	.	.
9.1	.	.	.	.	.	.	832	1387	1942	2497	3052
9.2	.	.	.	.	.	.	855	1425	1995	2565	3135
9.3	.	.	.	.	.	.	877	1462	2047	2632	3217
9.4	.	.	.	.	.	.	900	1500	2100	2700	3300
10.0	.	.	.	.	.	.

1CWT = 112LB.

APPENDIX No. 18—contd.

(Reference: Chapter VIII, Para 75)

READY RECKONER FOR COAL CONSUMPTION
(SHED SHUNTING—LB.)

II

LOCOMOTIVE GROUP GRATE AREAS.

Time Hours.							Upto 20 sq.ft.	21 sq. ft. to 30 sq.ft.	31 sq. ft. to 40 sq. ft.	41 sq. ft. to 50 sq. ft.	51 sq. ft. and above
0·0	.	.	.	.	.	.	0	0	0	0	0
1 $\frac{1}{4}$	.	.	.	.	.	.	30	50	70	90	110
1 $\frac{1}{2}$	.	.	.	.	.	.	60	100	140	180	220
1 $\frac{3}{4}$	.	.	.	.	.	.	90	150	210	270	330
1·0	.	.	.	.	.	.	120	200	280	360	440
1 $\frac{1}{4}$	.	.	.	.	.	.	150	250	350	450	550
1 $\frac{1}{2}$	.	.	.	.	.	.	180	300	420	540	660
1 $\frac{3}{4}$	.	.	.	.	.	.	210	350	490	630	770
2·0	.	.	.	.	.	.	240	400	560	720	880
2 $\frac{1}{4}$	.	.	.	.	.	.	270	450	630	810	990
2 $\frac{1}{2}$	.	.	.	.	.	.	300	500	700	900	1100
2 $\frac{3}{4}$	.	.	.	.	.	.	330	550	770	990	1210
3·0	.	.	.	.	.	.	360	600	840	1080	1320
3 $\frac{1}{4}$	.	.	.	.	.	.	390	650	910	1170	1430
3 $\frac{1}{2}$	.	.	.	.	.	.	420	700	980	1260	1540
3 $\frac{3}{4}$	.	.	.	.	.	.	450	750	1050	1350	1650
4·0	.	.	.	.	.	.	480	800	1120	1440	1760
4 $\frac{1}{4}$	.	.	.	.	.	.	510	850	1190	1530	1870
4 $\frac{1}{2}$	.	.	.	.	.	.	540	900	1260	1620	1980
4 $\frac{3}{4}$	.	.	.	.	.	.	570	950	1330	1710	2090
5·0	.	.	.	.	.	.	600	1000	1400	1800	2200
5 $\frac{1}{4}$	.	.	.	.	.	.	630	1050	1470	1890	2310
5 $\frac{1}{2}$	.	.	.	.	.	.	660	1100	1540	1980	2420
5 $\frac{3}{4}$	.	.	.	.	.	.	690	1150	1610	2070	2530
6·0	.	.	.	.	.	.	720	1200	1680	2160	2640
6 $\frac{1}{4}$	.	.	.	.	.	.	750	1250	1750	2250	2750
6 $\frac{1}{2}$	.	.	.	.	.	.	780	1300	1820	2340	2860
6 $\frac{3}{4}$	.	.	.	.	.	.	810	1350	1890	2430	2970
7·0	.	.	.	.	.	.	840	1400	1960	2520	3080
7 $\frac{1}{4}$	.	.	.	.	.	.	870	1450	2030	2610	3190
7 $\frac{1}{2}$	.	.	.	.	.	.	900	1500	2100	2700	3300
7 $\frac{3}{4}$	.	.	.	.	.	.	930	1550	2170	2790	3410
8·0	.	.	.	.	.	.	960	1600	2240	2880	3520
8 $\frac{1}{4}$	.	.	.	.	.	.	990	1650	2310	2970	3630
8 $\frac{1}{2}$	.	.	.	.	.	.	1020	1700	2380	3060	3740
8 $\frac{3}{4}$	.	.	.	.	.	.	1050	1750	2450	3150	3850
9·0	.	.	.	.	.	.	1080	1800	2520	3240	3960
9 $\frac{1}{4}$	.	.	.	.	.	.	1110	1850	2590	3330	4070
9 $\frac{1}{2}$	.	.	.	.	.	.	1140	1900	2660	3420	4180
9 $\frac{3}{4}$	.	.	.	.	.	.	1170	1950	2730	3510	4290
10·0	.	.	.	.	.	.	1200	2000	2800	3600	4400

1 CWT=112 LB

APPENDIX No 18—(contd.)
(Reference : Chapter VIII, Para 75)

**READY RECKONER FOR STEAM PREPARATION
(LIGHTING UP TO FULL PRESSURE-LB)**

III

LOCOMOTIVE GROUP GRATE AREAS.

Time Hours.	Upto 20 sq.ft	21 sq. ft. to 30sq. ft.	31 sq. ft. to 40sq. ft.	41 sq. ft. to 50sq. ft.	51 sq. ft. and and above.
0.0
1.4
1.5
1.6
1.7
1.8
1.9
2.0
2.1
2.2
2.3
2.4
2.5
2.6
2.7
2.8
2.9
3.0
3.1
3.2
3.3
3.4
3.5
3.6
3.7
3.8
3.9
4.0
4.1
4.2
4.3
4.4
4.5
4.6
4.7
4.8
4.9
5.0
5.1
5.2
5.3
5.4
5.5
5.6
5.7
5.8
5.9
6.0
6.1
6.2
6.3
6.4
6.5
6.6
6.7
6.8
6.9
7.0
7.1
7.2
7.3
7.4
7.5
7.6
7.7
7.8
7.9
8.0
8.1
8.2
8.3
8.4
8.5
8.6
8.7
8.8
8.9
9.0
9.1
9.2
9.3
9.4
9.5
9.6
9.7
9.8
9.9
10.0

1 CWT—112 LB.

APPENDIX No 18—(contd.)
(Reference : Chapter VIII, Para 75)
READY RECKONER FOR COAL CONSUMPTION
(BANKED FIRE TO FULL PRESSURE-LB)

IV

LOCOMOTIVE GROUP GRATE AREAS.

Time Hours.	Upto 20 sq. ft.	21 sq. ft. to 30 sq. ft.	31 sq. ft. to 40 sq. ft.	41 sq. ft. to 50 sq. ft.	51 sq. ft. and above.
0.0	0	0	0	0	0
1/4	30	50	70	90	110
1/2	57	95	133	171	209
3/4	86	143	201	258	316
1.0	112	187	262	337	412
1 1/4	139	232	325	418	511
1 1/2	165	275	385	495	605
1 3/4	184	327	430	553	676
2.0	204	340	476	612	758
2 1/4	220	367	514	661	808
2 1/2	235	392	549	706	863
2 3/4	249	415	581	747	913
3.0	262	442	612	787	962
3 1/4	273	455	637	819	1001
3 1/2	285	475	665	855	1045
3 3/4	295	492	689	886	1083
4.0	304	507	710	913	1116
4 1/4	313	522	731	940	1149
4 1/2	322	537	752	967	1182
4 3/4	330	550	770	990	1210
5.0	339	565	791	1017	1243
5 1/4	348	580	812	1044	1276
5 1/2	355	592	829	1066	1303
5 3/4	363	605	847	1089	1331
6.0	370	617	864	1111	1358
6 1/4	378	630	882	1134	1386
6 1/2	384	640	896	1152	1408
6 3/4	390	650	910	1170	1430
7.0	397	662	927	1192	1457
7 1/4	403	672	941	1210	1479
7 1/2	409	682	955	1228	1501
7 3/4	415	692	969	1246	1523
8.0	420	700	980	1260	1540
8 1/4	426	710	994	1278	1562
8 1/2	430	717	1004	1291	1578
8 3/4	433	722	1011	1300	1589
9.0	438	730	1022	1314	1606
9 1/4	441	735	1029	1323	1617
9 1/2	444	740	1036	1332	1628
9 3/4	446	743	1041	1338	1636
10.0	448	747	1046	1345	1644

1 CWT=112 LB.

APPENDIX No 18—(concl'd.)

(Reference : Chapter VIII, Para 75)

**READY RECKONER FOR COAL CONSUMPTION
(AWAITING MOVEMENT ORDERS—LB)**

V

LOCOMOTIVE GROUP GRATE AREAS.

Time Hours.	Upto 20 sq. ft.	21 sq. ft. to 30 sq. ft.	31 sq. ft. to 40 sq. ft.	41 sq. ft. to 50 sq. ft.	51 sq. ft. and above
0·0	0	0	0	0	0
1 ¹ / ₄	18	31	43	56	68
1 ¹ / ₂	37	62	87	112	137
1 ³ / ₄	56	93	131	168	206
1·0	75	125	175	225	275
1 ¹ / ₄	94	156	219	281	344
1 ¹ / ₂	112	187	262	337	412
1 ³ / ₄	131	219	306	394	481
2·0	150	250	350	450	550
2 ¹ / ₄	169	281	394	506	619
2 ¹ / ₂	187	312	437	562	687
2 ³ / ₄	206	344	481	619	756
3·0	225	375	525	675	825
3 ¹ / ₄	244	406	569	731	894
3 ¹ / ₂	262	437	612	787	962
3 ³ / ₄	281	469	656	844	1031
4·0	300	500	700	900	1100
4 ¹ / ₄	319	531	744	956	1169
4 ¹ / ₂	337	562	787	1012	1237
4 ³ / ₄	356	594	831	1069	1306
5·0	375	625	875	1125	1375
5 ¹ / ₄	394	656	919	1181	1444
5 ¹ / ₂	412	682	962	1237	1512
5 ³ / ₄	431	719	1006	1294	1581
6·0	450	750	1050	1350	1650
6 ¹ / ₄	469	781	1094	1406	1719
6 ¹ / ₂	487	812	1137	1462	1787
6 ³ / ₄	506	844	1181	1519	1856
7·0	525	875	1225	1575	1925
7 ¹ / ₄	544	906	1269	1631	1994
7 ¹ / ₂	562	937	1312	1687	2062
7 ³ / ₄	581	969	1356	1744	2131
8·0	600	1000	1400	1800	2200
8 ¹ / ₄	619	1031	1444	1856	2269
8 ¹ / ₂	637	1062	1487	1912	2337
8 ³ / ₄	656	1094	1531	1969	2406
9·0	675	1125	1575	2025	2475
9 ¹ / ₄	694	1156	1619	2081	2544
9 ¹ / ₂	712	1187	1662	2137	2612
9 ³ / ₄	731	1219	1706	2194	2681
10·0	750	1250	1750	2250	2750

1 CWT = 112 L.B.

APPENDIX 19 (a)

(Reference: Chapter VIII, Para 80)

STATEMENT SHOWING UN-CONNECTED AND MISSING WAGONS

Railways	Column I	Column II			Column III	Column IV	Column V	Column VI
	No. of wagons consigned from colliery base stations during the year only	No. of wagons received in sheds during the year only			Total unconnected wagons	No. of wagons missing as at the end of the year Diff. of Col. I & II (a)	Wagons in Col. III traced upto 31-3-57	Number of wagons in Column IV traced upto 31-3-57
		Against those in Col. I II (a)	Wagons unconnected for lack of despatch particulars II (b)	Unconnected due to wagon interception or diversion II (c)				
					II (b) II (c)			
1954-55								
Central . . .	121,500	117,732	3,409	2,409	5,818	3,768	3988	3,475
Eastern . . .	87,645	87,484	..	185	185	161	38	76
Northern . . .	73,046	72,240	445	378	823	806	Out of col. 464 Out of col. II (c) 378	589
N. Eastern . . .	40,773	39,873	..	Not Available		900	..	178
S. Eastern . . .	73,990	73,928	..	45	45	62	15	62
Southern . . .	30,168	28,684	671		671	1484	102	917
Western . . .	65,833	61,505	2727	415	3,142	4,328	2,675	1,217
TOTAL	492,955	481,446			10,684	11,509	7,282	6,514
		Percentage over wagons consigned			2.2%	2.3%	1.5%	1.3%
1955-56								
Central . . .	125,875	122,780	2,363	2,909	5,272	3,095	2,566	2,176
Eastern . . .	88,112	87,748	..	139	139	364	60	302
Northern . . .	64,655	63,725	972	830	1802	930	Out of Col. 1,008 Out of Col. II (c) 830	577
N. Eastern . . .	39,259	38,533 (	1819	)	1819	726	43	96
S. Eastern . . .	75,355	75,246	..	254	254	109	..	89
Southern . . .	43,613	39,490 (	1138	)	1,138	4,123	365	3,169
Western . . .	70,735	66,169	1894	276	2,170	4,566	1,532	2,956
TOTAL	507,604	493,691			12,594	13,913	5,574	9,365
		Percentage over wagons consigned			2.5%	2.7%	1.1%	1.8%
1956-57								
Central . . .	136,809	132,479	2,636	4,364	7,000	4,330	2,539	2,159
Eastern . . .	91,772	91,312	..	349	349	460	173	233
Northern . . .	85,028	83,689	1,172	1,213	2,385	1,339	Out of Col. 1,585 Out of Col. II (c) 1213	455
N. Eastern . . .	46,493	43,181 (	1713	)	173	3312	1	69
S. Eastern . . .	81,630	81,099	—	318	318	531	..	..
Southern . . .	47,242	44,885 (	354	)	354	2,357	30	1,556
Western . . .	76,675	71,937	3611	1089	4,700	4,738	..	..
TOTAL	565,649	541,582			15,279	17,067	4,328	4,472
		Percentage over wagons consigned			2.7%	3.2%	0.8%	0.8%

APPENDIX No. 19(b)
(Chapter VIII, para 80)

A centralised system of linking on the lines detailed below should be introduced to improve matters :

(a) *'Unconnected' wagons, arising from interceptions :—*

The Operating Department of each Railway should regularly collect the necessary particulars of rebooking (diversions) and/or interceptions from each Division, District, giving the following particulars :—

- (1) Wagon No.
- (2) Name of the Colliery base station.
- (3) Owing Railway.
- (4) Railway Receipt No. and date.
- (5) Original Consignee.
- (6) New consignee.
- (7) Particulars of Re-booking.

These statements should be consolidated and submitted to the Central Accounts Office, say, twice a month. The Accounts Office should furnish information to their counterparts on other Railways in respect of wagons originally consigned to them.

(b) *'Unconnected' wagons arising from missing particulars :—*

Each Railway should similarly furnish to the accounts Branch of the Ministry of Railways where a Central Clearance Unit may be set up, the following particulars, monthly :—

- (1) Wagon No. and owning Railway.
- (2) Date of Receipt in shed or at distributing centre.
- (3) Quantity.
- (c) *"Missing" Wagons —*

The Central Accounts Office of each Railway should prepare a monthly statement of 'missing' wagons within two months (*i.e.*, for wagons despatched in April, the statement should be prepared by the end of June) and submit to the Central Clearance Unit of the Accounts Branch of the Ministry of Railways. The statement should contain the following particulars :—

- (1) Name of the Railway.
- (2) Name of the base station from which despatched.
- (3) Wagon No. and owning Railway.
- (4) Railway Receipt particulars.
- (5) Quantity.

APPENDIX No. 20
(Reference: Chapter IX, Para 88)
Additional Quantity of Coal of Various Grades Over 1955 Production (Coking and Non-Coking) Estimated to be Raised Fieldwise by 1960-61 (Figures in Million Tons)

FIELDS		SECTION		COKING					NON-COKING					Remarks.	
		Sel. A	Sel. B	Gr. I	Gr. II	Un-Graded	Total	Sel. A	Sel. B	Gr. I	Gr. II	Un-graded	Total		Grand Total
1. Raniganj	Private	0.25	..	..	..	..	0.25	0.74	3.00	1.55	0.16	..	5.45	5.70	} 2.25—Coking. 1.00—Non-Coking.
2. Jharia	Private	0.26	1.25	0.94	0.80	..	3.25	..	..	..	..	..	..	3.25	
3. Karampura	Public	..	..	..	..	..	..	..	2.30	1.10	..	..	3.40	3.40	Increase in Saunda Bachra & further new area Chordhura by NCDC.
4. Karampura	Private	..	..	0.09	0.01	..	0.10	..	0.25	0.15	0.05	..	0.45	0.55	No change.
5. Bokaro	Public (New area) Kathra	..	..	1.50	..	..	1.50	..	..	..	..	..	..	1.50	
6. Korba	Public	..	..	..	..	..	..	1.00	0.50	..	..	..	1.50	1.50	No output expected during 2nd Plan period. Previous target was 1m. tons.
7. Central India	Public Bishrampur/Jhilmili	..	..	..	..	..	..	..	..	..	..	..	..	..
8. Central India	Public Korea block	..	..	..	..	..	..	..	0.50	..	..	..	0.50	0.50	No charge in total quality all in Sel. B now against previous estimate of 50% Sel. B and 50% Gr. I.
9. Central India	Private Korea & Rewa	..	..	..	..	..	..	..	..	..	..	1.00	1.00	1.00	
10. Singareni Collieries		..	..	..	..	..	..	..	..	..	..	1.50	1.50	1.50	1.96 Existing Collys.=0.5m. tons. Expansion of Existing Collys.= 1.81 "
11. Existing State Collieries		..	..	..	..	..	..	..	..	..	..	..	..	..
(Collierywise and Fieldwise breakdown not known).															
TOTAL		0.51	1.25	2.88	0.81	..	5.45	1.74	8.36	2.95	0.21	2.50	15.76	21.21	To this we may add Kathara 1.50 m. tons and the total comes to 15.76 + 1.50 = 17.26 m. tons. 3rd of 17.26 m. tons. = 11.51 m. tons.

NOTE: As regards additional production by the end of the 3rd Five Year Plan no fieldwise estimates have yet been worked out.

APPENDIX No. 22(a)

(Reference : Chapter XI, Paras 99, 101)

BASIS FOR ESTIMATING PERFORMANCE AND OPERATING COSTS OF DIFFERENT TYPES OF LOCOMOTIVE POWER.

Item No.	Description	Steam	Diesel	Electric
1	Loco H.P. Rating for same hauling capacity .	1650 WP/WG	2400	2400
2	H.P./Ton of weight Loco weight in tons	10 *160 WP/WG	20 120	30 80
3	Annual - Mileage Ratio	1	1.25	1.5
	Annual Mileage } Pass. .	56000	70000	84000
	. . . . . } Goods	33000	41300	49500
4	(a) Trailing Train load ** } Pass. .	450W.P.	540 } Steam + 20%	540 } Steam + 20%
	. . . . . } Goods. .	1200W.G.	1440 } Loco. weight plus	1440 } trailing train load.
	(b) Gross Train load			
5	(a) Trailing Ton Miles per loco. per annum		Annual mileage X trailing train load.	
	(b) Gross Ton Miles per loco. per annum		Annual mileage X Gross Train load.	
6	Loco Price Ratio	1	2.44	2.35
	Price in Rs.	5,11,000	12,50,000	12,00,000
7	Interest rate per annum	4%	4%	4%
	Depreciation per annum (on sinking fund method)	2%	2½%	1½%
8	Crew	1 Driver & 2 Firemen	1 Driver & 1 Asstt. Driver.	1 Driver & 1 Asstt. Driver
	Crew mileage per month } Pass. .	4700 WP	4700 X 1.15 = 5405	4700 X 1.3 = 6110
	. . . . . } Goods	2750 W.G.	2750 X 1.15 = 3163	2750 X 1.3 = 3575
	Crew earnings per month Rs. } Pass. .	875	735	735
	(Includes salary P.F. mileage & D.A.) } Goods	620	564	564
	Crew cost per mile Rs. } Pass. .	0.187	0.136	0.120
	. . . . . } Goods. .	0.226	0.179	0.158
9	Maintenance and repair cost per engine mile Rs.	0.5	0.65	0.3
10	Cost per engine mile			
	Lubrication	0.05	0.01	0.01
	Water	0.05	0.01	..
	Other supplies	0.02	0.01	0.01
11	Fuel energy per 1000 G.T.M. } Pass. .	Coal 185 lb.	Diesel oil 18 lb.	Electrical Energy 34 KWH
	. . . . . } Goods. .	241 150 lb.	16 lb.	34 KWH
12	Operating cost per loco. per annum	Sum of items 7, 8, 9, 10 & 11.		
13	Operating cost per 1000 Trailing Ton Miles	Item 12 ÷ Item 5(a)		
14	Pass : Goods Ratio . . . . .	..	1.2	..
15	Fixed cost of electric track equipment and installation Rs./Track mile/annum			9,600 } 8% on Rs. 1.2 lakhs per track mile. 4% interest 2% maintenance. 2% depreciation

*Average weight of steam locomotive is taken 75% of coal and water on tender.

**Effective trailing load is taken at 75% of the Design Trailing load on level track.

APPENDIX No. 22(a)—*contd.*
(Reference :—Chapter XI, Paras 99 & 101)
BROAD GAUGE

PERFORMANCE AND OPERATING COSTS OF DIFFERENT TYPES OF LOCOMOTIVE POWER

Serial No.	Description	Steam		Electric		Diesel	
		Passenger	Goods	Passenger	Goods	Passenger	Goods
1	Locomotive H. P. Rating	1650	1650	2400	2400	2400	2400
2	Locomotive weight (in tons)	160	160	80	80	120	120
3	Annual Mileage per loco	56000	33000	84000	49500	70000	41300
4	Gross Train load (tons) including weight of the locomotive	610	1360	620	1520	660	1560
5	Effective Trailing Train load (tons) excluding weight of the locomotive	450	1200	540	1440	540	1440
6	Trailing Ton Miles per loco per annum	25.2 × 10 ⁶	39.6 × 10 ⁶	45.36 × 10 ⁶	71.28 × 10 ⁶	37.8 × 10 ⁶	59.47 × 10 ⁶
7	Gross Ton Miles per loco per annum	34.2 × 10 ⁶	44.8 × 10 ⁶	52.08 × 10 ⁶	75.24 × 10 ⁶	46.2 × 10 ⁶	64.43 × 10 ⁶
8	Capital cost per loco, Rs.	511000	525000	1200000	1200000	50000	1250000
9	Interest and depreciation per loco per annum (Rs.)	30660	31500	66000	65000	81250	81250
10	Crew cost per loco per annum	10472	7458	10080	7821	9520	7393
11	Maintenance and repairs per loco per annum (Rs.)	28000	16500	25200	14850	45500	26800
12	Lubrication water and other supplies per loco per annum (Rs.)	6700	3960	1620	990	2100	1239
Cost of fuel energy in Rupees per loco per annum.		Coal rate Rs./Tons		Energy As/KWH		Diesel oil Rs./Ton	
13	Steam :	20	56491	33201	47956	250	92812
	Pass 185 lb./1000 GTM	30	84736	44268	63954	260	96525
	Goods :	40	112981	55335	79943	270	100238
	150 lb./1000 GTM	50	141226	66402	95931	280	103951
	Electric :	60	169471	77469	111920	300	111376
	34 KWH/1000 GTM	80	225962	88536	127908	320	118801
	Diesel :			99603	143897	340	126226
	Pass 18 lb./1000 GTM			110670	159885	360	133651
	Goods			132804	191862	380	141076
	16 lb./1000 GTM			154938	223839	400	148500
				177072	255816		184036

APPENDIX No. 22(a)—*contd.*
(Reference :—Chapter XI, paras 99 and 101)
BROAD GAUGE
PERFORMANCE AND OPERATING COSTS OF DIFFERENT TYPES OF LOCOMOTIVE POWER

Serial No.	Description	Steam		Electric		Diesel	
		Passenger	Goods	Passenger	Goods	Passenger	Goods
14	Total Operating cost per loco per annum (Rs.)	Coal Rate Rs./Ton		Energy As./KWH		Diesel Oil Rs./Ton	
		20	132323	0.3	137617	250	231182
		30	160568	0.4	153615	260	234895
		40	188813	0.5	169604	270	238608
		50	217058	0.6	185592	280	242321
		60	245303	0.7	201581	300	249746
		80	301794	0.8	217569	320	257171
				0.9	233558	340	264596
				1.0	249546	360	272021
				1.2	281523	380	279446
				1.4	313500	400	286870
				1.6	345477		
				0.3	1.93	250	6.11
				0.4	2.16	260	6.21
15	Operating cost in Rs. per 1000 Trailing Ton Miles	20	5.25	3.00	2.38	270	6.31
		30	6.37	3.25	2.60	280	6.41
		40	7.49	3.49	2.82	300	6.60
		50	8.62	3.74	3.05	320	6.80
		60	9.73	3.98	3.28	340	7.01
		80	11.98	4.22	3.50	360	7.19
				4.46	3.95	380	7.39
				4.71	4.40	400	7.59
				5.19	5.68		
				6.17	4.85		

PERFORMANCE AND OPERATING COSTS OF DIFFERENT TYPES OF LOCOMOTIVE POWER

Serial No.	Description	Steam		Electric		Diesel	
		Passenger	Goods	Passenger	Goods	Passenger	Goods
16	Average Operating cost on Passenger—Goods Ratio of 1:2 Rs. per 1000 Trailing Ton Miles	Coal Rate Rs./Ton		Energy As./KWH		Diesel Oil Rs/Ton	
		20	*3.76	0.3	**2.29	250	4.64
		30	4.64	0.4	2.52	260	4.72
		40	5.52	0.5	2.75	270	4.81
		50	6.39	0.6	2.98	280	4.89
		60	7.27	0.7	3.21	300	5.06
		80	9.03	0.8	3.44	320	5.23
				0.9	3.67	340	5.40
17	Fixed cost of Electric Track Equipment and installation Rs. per single track mile per annum.						
				@ Rs. 9600.			

Note.—Formula according to which the Balancing Traffic Densities in Million Trailing Tons per Single track Mile are Worked out.

Electric traction

$$\left\{ \begin{array}{l} \text{Balancing traffic density in} \\ \text{trailing tons per single track} \\ \text{mile per annum} \end{array} \right\} \times \left\{ \begin{array}{l} \text{Operating cost of Electric} \\ \text{traction per trailing ton mile} \end{array} \right\} + \left\{ \begin{array}{l} \text{Fixed cost per track} \\ \text{electric installation and equip-} \\ \text{ment.} \end{array} \right\} \times \left\{ \begin{array}{l} \text{mile of} \\ \text{track} \end{array} \right\} = \left\{ \begin{array}{l} \text{Balancing traffic density in trailing tons per single} \\ \text{track mile per annum} \end{array} \right\} \times \left\{ \begin{array}{l} \text{Operating cost of steam} \\ \text{traction per trailing} \\ \text{ton mile} \end{array} \right\}$$

Example at cost of coal at Rupees 20/- per ton and electric energy at 0.3 anna per unit.

Let 'Y' represent the Balancing Traffic Density in 1000 Trailing Tons per single track mile.
Substituting values in the above formula,

$$(Y) > \frac{(*2.29) + (@9600)}{6530} = \frac{(Y) \times (*3.76)}{6530}$$

from which Y = 6530 Thousand Trailing Ton Miles
or 6.53 × 10⁶ Trailing Ton Miles.
Similarly the other values have been worked out.

APPENDIX No. 22 (a)—*contd.*
(Reference Chapter XI Paras 99 and 101)

BALANCING TRAFFIC DENSITY IN MILLION TRAILING TONS PER SINGLE TRACK MILE PER ANNUM

At cost of coal in Rs/ Ton	At cost of Electric Energy in As./KWH										
	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.2	1.4	1.6
20 . . .	6.53	7.24	9.51	12.31	17.48	..	..	..	..	..	..
30 . . .	4.08	4.52	5.08	5.78	6.72	8.00	9.90	12.98	..	..	..
40 . . .	2.98	3.20	3.47	3.78	4.16	4.62	5.18	5.93	8.28	13.92	..
50 . . .	2.34	2.48	2.64	2.82	3.02	3.26	3.53	3.86	4.73	6.15	8.73
60 . . .	1.96	2.02	2.12	2.24	2.37	2.51	2.67	2.85	3.30	3.94	4.85
80 . . .	1.42	1.48	1.53	1.59	1.65	1.72	1.78	1.87	2.06	2.29	2.56

APPENDIX No. 22(a)—*contd.*

Railway	Section to be electrified.	Route Miles	Track Miles	Traffic density Trailing Ton Miles per annum per track mile during 1956-57 (in million)	Average delivered cost of Coal Rs./Ton.	Maximum cost of electric energy which will justify electrifica- tion (AS./kwh.)
I. CENTRAL RAILWAY	1. Igatpuri-Bhusawal	191	382	5.67	39.46	0.95
	2. Itarsi-Bina	143	143	7.55	37.41	1.06
	3. Bina-Jhansi	94	94	6.17	37.92	0.94
	4. Jhansi-New Delhi	255	299	4.41	38.45	0.70
II. WESTERN RAILWAY	1. Virar-Baroda	208	417	6.79	41.92	1.16
	2. Baroda-Ratlam	161	161	10.80	39.08	1.29
	3. Ratlam-Nagda	26	26	11.62	38.10	1.27
	4. Nagda-Gangapur	246	246	7.56	38.44	1.10
	5. Gangapur-Bayana	48	48	8.64	36.51	1.10
	6. Baroda-Ahmedabad	62	102	7.46	41.02	1.20
II SOUTHERN RAILWAY :	1. Madras-Bezwada	267	267	7.52	53.70	More than 1.60
	2. Bezwada-Waltair	217	217	6.47	36.23	0.91
	3. Madras-Arkonam	42	85	5.31	65.45	More than 1.60
	4. Arkonam-Jalarpet	90	90	6.59	56.20	More than 1.60
	5. Jalarpet-Erode	111	111	5.39	65.45	More than 1.60



APPENDIX NO. 22 (b)

(Reference : Chapter XI, Para 99)

ECONOMIC COMPARISON BETWEEN STEAM AND DIESEL POWER FOR SHUNTING SERVICES

Item No.	Description	Steam	Diesel.
I	Mileage { Hours in Service per day Miles per day @ 5 M. P. H. Days in use per annum Total mileage per annum	16 80 260 20,800	20 100 300 30,000
II	Capital cost per Loco	250000	400000
<i>COSTS.</i>			
III	Interest on Capital cost { Rate per annum Total Rs./Annum	4% 10,000	4% 16,000
IV	Depreciation on Capital Cost { Rate per annum Total Rs. per annum	2% 5,000	2½% 10,000
V	Crew Cost { crew— Crew earnings Rs./month. Crew mileage per month Crew cost per mile Total crew cost Rs./annum per loco	Shunter & Fireman 242 1,000 0.242 5,040	Shunter 140 1,000 0.14 4,200
VI	Maintenance and repair cost { Rs./Mile Total (Rs./annum)	0.5 10,400	0.6 18,000
VII	Lubrication water and Other supplies { Rs. per mile Total Rs. per annum	0.12 2,500	0.12 3,600

APPENDIX No. 22 (b)—*contd.***ECONOMIC COMPARISON BETWEEN STEAM AND DIESEL POWER FOR SHUNTING SERVICES**

Item No.	Description	Steam		Diesel.	
		@ Coal rate		@ Oil rate	
VIII	Fuel cost per annum (Rs.)	20	13,000	250	20,100
	Fuel consumption rate . } Steam-70 lb. coal/mile	30	19,500	275	22,100
	} Diesel-61thlb. oil/mile	40	26,000	300	24,100
		50	32,500	325	26,100
		60	39,000	350	28,100
		@ Coal rate		@ Oil rate	
		20	45,940	250	71,900
		30	52,440	275	73,900
IX.	Total Operating cost-Rs. per annum	40	58,940	300	75,900
		50	65,440	325	77,900
		60	71,940	350	79,900
		20	2.21	250	2.40
		30	2.52	275	2.46
X.	Operating cost-Rs. per shunting mile	40	2.83	300	2.53
		50	3.15	325	2.60
		60	3.46	350	2.69

*NOTE—Crew Earnings per month (Rs.)

	Shunter	Fireman
Pay and Mileage	80	50
D. A.	50	45
P. F. & G. R.	10	7
TOTAL	140	102

APPENDIX No. 23

(Reference : Chapter XI, para 100.)

A Note on

The Availability And Supply of Diesel Fuels in India

by

The Director, Fuel Research Institute, Dhanbad.

The potential production capacity of the refineries at present existing and planned at Bombay, Visakhapatnam and Digboi is estimated as follows :

TABLE I

	Rated (m. tons per annum)	Potential
Bombay	3.25	4.230
Visakh	0.50	0.675
Digboi	0.35	0.420
TOTAL	4.10	5.325

On the basis of the above production, the following petroleum products are likely to be available by 1962.

TABLE II

(000 tons)

Aviation spirit	Nil
Motor spirit	1307
Super. kerosene/aviation turbine fuel (ATF)	688
Inferior kerosene	52
High speed diesel (HSD)	746
Light oil (diesel) (LDO)	353
Furnace oil	1632
TOTAL	4778

The Table below gives a conservative assessment of the requirements of petroleum products for India by '62.

TABLE III

(000 tons)

Aviation spirit	96
Motor spirit	1094
Superior kerosene (ATF) & Inferior kerosene	2726
H. S. D.	1610
L. D. O.	545
Furnace oil	1072
TOTAL	7143

APPENDIX No. 23 (contd.)

On the basis of the above production and requirements, the anticipated demands and surplus of petroleum products in India by 1962 is assessed as follows :

TABLE IV

(Figures in thousand tons)

	Anticipated production	Anticipated demands	Surplus or deficit in 1962
Aviation spirit	Nil	96	—96
Motor spirit	1,307	1,094	+213
Sup. kerosene (ATF) }	740	2,726	—1,986
Inf. kerosene }			
High speed diesel (HSD)	746	1,610	—864
Light diesel oil (LDO)	353	545	—192
Furnace oil	1,632	1,072	+560
	4,778	7,143	..

The Table, however, does not take into account any special development in dieselisation of the Railways. The estimates are based on normal increase in requirements of petroleum fuels in India. Taking the above factors into consideration and an economic area of distribution, as well as demands of petroleum fuels within this economic area, the estimates have been prepared on two alternative bases for 1.5 million tons refinery based on newly discovered Assam crude.

TABLE V

(In thousand tons)

	A. Maximum Aviation Spirit	B. Maximum Kerosene
Aviation Spirit	205	Nil
Motor spirit	433	419
High speed diesel oil	75	75
White kerosene	193	193
Red kerosene	Nil	104
Light diesel oil	132	132
Furnace oil	225	340
	1,263	1,263

The above Table gives the products that will be obtained from the refineries in case aviation spirit is one of the items of manufacture. B is on the basis that there will be no production of aviation spirit.

TABLE VI

(Thousand tons)

Products	Anticipated demand in 1962	Estimated	Production	Surplus or deficit	
		1.5m. tons refinery	2 m. tons refinery	1.5m. tons refinery	2m. tons refinery
Aviation Spirit	23	205	274	+182	+251
Motor Spirit	294	433	578	+139	+284
Sup. kerosene/ATF	511	193	257	—496	—432
Inf. kerosene	178				
H. S. D.	227	207	276	—98	—29
L. D. O.	78				
Furnace oil	134	225	300	+91	+166

APPENDIX No. 23 (contd.)

Table VI gives the anticipated surplus or deficit in the economic area of distribution based on Assam crude by 1962.

It will be seen that whereas motor spirit, aviation spirit and furnace oil will be produced in surplus, kerosene and diesel oil will be in deficit.

Regarding the furnace oil, the surplus in this product is estimated between 91,000 tons and 166,000 tons in addition to the already anticipated All-India surplus of 560,000 tons. The actual surplus of furnace oil will be much greater than the estimates given above. Much of the furnace oil requirements of the country assumed in Table IV can be replaced by coal-tar fuels, which will be available from the steel plants in large quantities and the anticipated demands under Table IV are also arbitrary.

The present consumption of furnace oil does not justify the increased consumption assumed. It has been mainly based on the assumption that the Heavy Industries to be newly found will become a consumer of this commodity due to adjustments and possibly as a regulatory measure.

It has also been proposed that in view of the large excess in production of furnace oils, recourse may be taken to utilise these furnace oils for carbon black production or for production of bitumens for road.

Although the initial target for production of crude oil at Naharkatia has been accepted at 2.5 million tons per annum, an ultimate production of 4.5 million tons per annum is considered possible on the basis of 37.8 million tons reserves assessed. The production of additional diesel fuels from this source is, therefore, possible.

An examination of the balance production-consumption on All-India basis shows the following picture :—

TABLE VII

In 1000 T/Y

	Economic area	All-India
Superior kerosene	254	1,395
Inferior kerosene	178	334
H. S. D.	127	764
L. D. O.	excess 98	16
and the following excess		
Motor spirit	284	791
Furnace oil	166	860

90% by weight and almost 100% by volume of this excess furnace oil can be converted into diesel fuels.

The hydrogenation of the corresponding cuts of coking and catalytic cracking will produce an extra quantity of high speed diesel and/or low speed diesel. For this cracking of excess from the catalytic cycle oil there will be corresponding reduction of furnace oil in the refineries. Further, when processing paraffinic crudes under certain conditions, it is possible to use a part of the catalytic cycle oil as high speed diesel by mixing it with a large amount of straight run distillate of high diesel index, though it is doubtful whether this can be possible with Naharkatia crude.

These processes refer to production of diesel oil from the refineries within the normal scope of operations. However, diesel oil can be produced from these sources and particularly from the furnace oil fraction by high pressure catalytic hydrogenation in the gas phase similar to the process adopted for low temperature tar from coal carbonisation. In fact, low temperature carbonisation tar is more refractory towards hydrogenation. The Bergius process developed in Germany uses a high pressure of over 450 atm. for hydrogenation. Recent work carried out at the Central Fuel Research Institute, as well as abroad have shown the possibilities of carrying out the hydrogenation at much lower pressure—i.e., in the neighbourhood of 100 atm., thus considerably reducing the capital costs and increasing the yields in conversion.

However, for hydrogenation of either the coal-tar or furnace oil, minimum economic units will be of the order of 100,000 tons per annum capacity. If, therefore, the Railways' demands for diesel fuels have to be met, the Government may be approached to provide for such hydrogenation plants at individual refineries where there will be adequate surplus production of furnace oil for installation of minimum economic units. As far as groups of refineries are concerned, such as at Bombay, the furnace oil from different refineries can be pooled into one hydrogenation unit.

The advantage of carrying out the hydrogenation alongside the refinery is that the required hydrogen can be obtained from the surplus refinery gases by suitable treatment.

However, hydrogenation of furnace oil can only partially meet the long-term requirements. Recourse will, therefore, have to be made also to produce diesel oil from other indigenous sources.

APPENDIX No. 23 (concl'd.)

It has been proposed that in the course of next 15—20 years, 50 million tons of coal should be carbonised for production of smokeless fuel for the populace as a measure for supply of household fuels and particularly, as a conservation measure for soil and prevention of deforestation. Carbonisation of 50 million tons of coal will leave approximately 5 million tons of low temperature tar and even if only the distillates, after removing all pitch, are hydrogenated approximately 2·5 million tons of diesel oil can be obtained from this source, as a by-product of the domestic coke manufacture by low temperature carbonisation process.

The direct synthesis of diesel oil from coal via gasification is also possible. In this technique, coal will be gasified with steam and oxygen to produce carbon monoxide and oxygen from which diesel oil can be catalytically synthesised by the well-known Fischer-Tropsch technique.

The Fischer-Tropsch process, produces a very high grade of diesel oil in view of the paraffinic nature of the synthesised product.

Low grade coal, even containing 40% ash (e.g. middlings from washeries) can be gasified as powdered coal and approximately 5-6 tons of coal will be required for production of each ton of diesel oil. In addition to diesel oil, there will be some motor spirit and other chemicals produced during synthesis, which will be welcome to the industrial economy of the country.

In view of the requirements of the Railways and the dilemma that the Railways will be faced with, in order to meet their fuel requirements in the not too distant a future, *it is suggested that the Government and the Planning Commission be made aware of the situation, so that necessary steps can be taken in time.* Dependence on direct use of coal, although it will continue for many years to come as far as the Railways are concerned, can no longer be expected to meet the increased requirements of fuels by the Railways. There cannot be any doubt that *the cost of production of coal will increase* with the increased difficulties in mining, with increased exhaustion of the easily mineable seams, with the exhaustion of the better quality coals and increased cost of cleaning of inferior grades of fuels, increased cost of labour and machinery.

The picture that may emerge to-day as comparative on the basis of coal-costs will no longer be applicable in future. It is also certain that for many purposes, e.g. for carbonisation for steel industry and others, much of the future output of coal will have to be cleaned. This will inevitably produce very large quantities of middlings and rejects, which nevertheless will contain 50 % or more of carbon. Throwing away all the rejects will, on the one hand, be a great national loss and on the other, the large quantities that will be produced will constitute a grave problem with regard to utilisation.

The easiest approach will be to convert these by-product fuels into power and liquid fuels. Whereas generation of power at any particular point—and the washeries will be chiefly located in the coalfields themselves, which are regionally concentrated—will have a limit in view of the power requirements in the area concerned, *liquid fuels produced in these centres can always be economically transported over a large area of the country.*

Blending of the natural liquid fuels with the synthesised fuels will improve the quality of both.

In a recent appraisal of the energy-economy position of the U.K., and, in particular in relationship to the advent of atomic power in that country, the entire programme of coal research is being reoriented chiefly for production of liquid fuels from coal by improved techniques. The British Ministry of Fuel and Power has, thus, launched a £ 3 million research scheme for production of synthesis gas by the slagging technique for production of synthetic oil from coal.

Since the low grade energy in the form of inferior grades of coal available in abundance in the country will have limited scope for application, conversion of this low grade fuel to higher forms of energy which can be utilised with much higher efficiencies is the only logical solution for meeting our future requirements.

Regarding the costs of production, it has been shown by the Experts Committee on Synthetic Fuels appointed by the Government under the Chairmanship of Dr. J. C. Ghosh, that even on the basis of the present day techniques and costs and based on modern machinery and imported equipment, the project will be competitive with liquid fuels obtained from natural sources and imported from abroad.

The energy-economy of the country and the resources of energy, place a vital responsibility on the Government for long term planning, and unless steps are taken early in the direction of research and development and establishment of proto-type plants for studying the production costs and techniques under actual conditions, lack of specific forms of energy sources may seriously handicap development of the country in future.

Special emphasis is necessary on the production of liquid fuels, particularly diesel fuels, from indigenous sources based on either natural crude oil or coal tar and ultimately coal itself, and the Govt. should be advised to take early steps towards the realisation of these plans.

APPENDICES

Appendix No.	Subject	Reference	
		Chapter No.	Para No.
1(a)	Letter of appointment of the Expert Committee to examine the increased cost of fuel consumption on Railways.	Introduction	
1(b)	Questionnaire	Do.	
2	Analysis showing the quantity of coal received, pit head costs, freight charges paid thereon as well as a break-up of the increase in costs due to increase in quantity and due to rise in pit head costs and freight rates.	II	16
3	Statement showing the quantities of coal handled, handling costs incurred etc. by Railways, during the years 1954-55 to 1956-57.	II VI	16 50
4	Incidental costs on coal incurred by Railways during the years 1954-55 to 1956-57.	II	16
5	Statement showing the number of collieries which supplied coal to individual Railways during 1954-55 to 1956-57 and the quantities supplied gradewise.	III	20
6	Maximum and minimum number of collieries that supplied coal to major sheds during any one month and the monthly average for the year 1956-57.	III	20
7(a)	Results of Rapid Quality Survey--Tests carried out in September 1957 (Bengal and Bihar coals)	III	22
7(b)	Results of Rapid Quality Survey--Tests carried out in January 1958. (Bengal and Bihar coals)	III	23
7(c)	Results of Rapid Quality Survey--Tests carried out in September 1957 and January 1958 (Outlying Fields)	III	25
8	Statement showing quantities of coal consumed, rate of consumption of coal per 1000 Gross Ton Miles, Train Miles, Train Engine and Other Engine Hours etc., in respect of different services (Broad Gauge and Metre Gauge) during the years 1952-53 and 1954-55 to 1956-57.	IV	29 31 32
9	Statement showing Broad Gauge and Metre Gauge locomotives working on Passenger, Mixed and Goods services, according to age groups during 1952-53, and 1954-55 to 1956-57.	IV	33
10	Results of reweighments of coal wagons at colliery base stations situated on the Eastern, Central and South Eastern Railways.	V	39
11(a)	Results of reweighments of coal wagons at various Railway sheds by Inspectors deputed by the Expert Coal Committee.	V	40
11(b)	Results of reweighments of coal wagons at various loco sheds by Railways at the instance of the Expert Coal Committee.	V	40
12	Sketch showing an improved method of Tender calibration	V	42
13	Summary of the results of the service trials conducted at certain sheds on Railways on Mail and Express, Passenger and Goods services showing the difference between trip rations and the actual consumption during trials.	V	45
14	Statement showing costs of handling and sale proceeds of ashes and cinders	VI	61
15	Statement showing the quantities of coal carried by sea and rail route from the Bengal and Bihar Coalfields, as well as from the Outlying Fields and the freight paid thereon by the Southern Railway.	VII	64 & 65
16	Number of complaints made by Railways to the Coal Controller regarding high percentage of 'ash' and 'smalls and dust' in coal supplied during the years 1954-55 to 1956-57 and the number of cases outstanding at the end of each year.	VIII	74

Appendix No.	Subject	Reference	
		Chapter No.	Para No.
17	Shed services register	VIII	75
18	Ready reckoner for assessment of coal consumption in shed services	VIII	75
19(a)	Statement showing for the years 1954-55 to 1956-57, the number of wagons consigned to each Railway from colliery base stations, number of wagons received, unconnected, etc.	VIII	80
19(b)	Linking of 'Missing' and 'unconnected' wagons	VIII	80
20	Additional quantity of coal of various grades over the 1955 production (coking and non-coking) estimated to be raised fieldwise by 1960-61.	IX	88
21	Summary of estimated products, (Qualitative and quantitative) obtainable from the proposed washeries for railways.	X	94
22(a)	Characteristic features of the different types of locomotive power (statements and graph).	XI	99 & 101
22(b)	Economic comparison between Steam and Diesel power for shunting services (Statement and graph)	XI	99
23	A note on the availability and supply of diesel fuels in India by the Director, Fuel Research Institute, Dhanbad.	XI	100



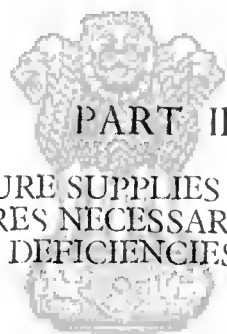


APPENDICES

PART I
COAL CONSUMPTION AND EXPENDITURE



सत्यमेव जयते

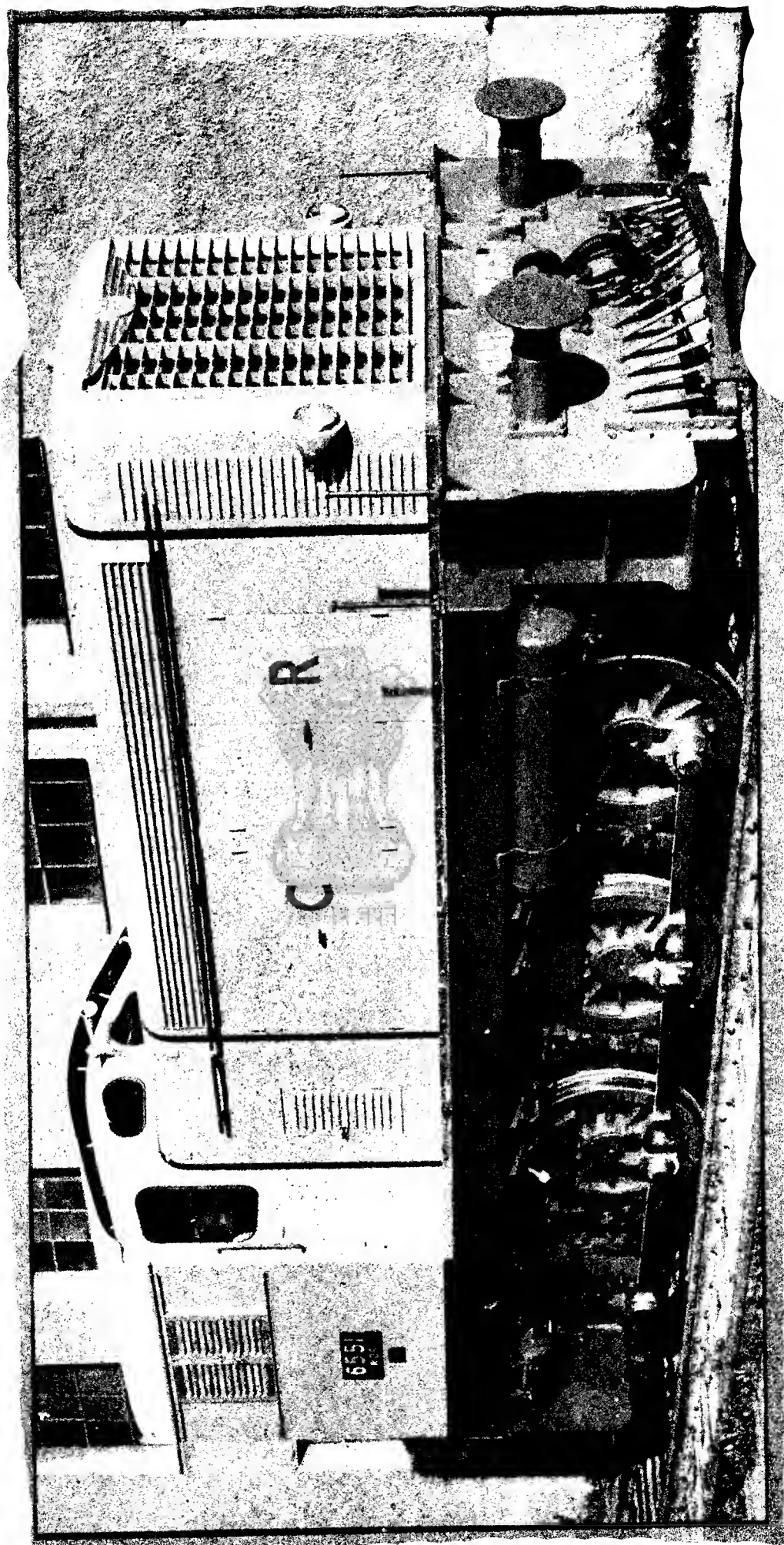


PART II

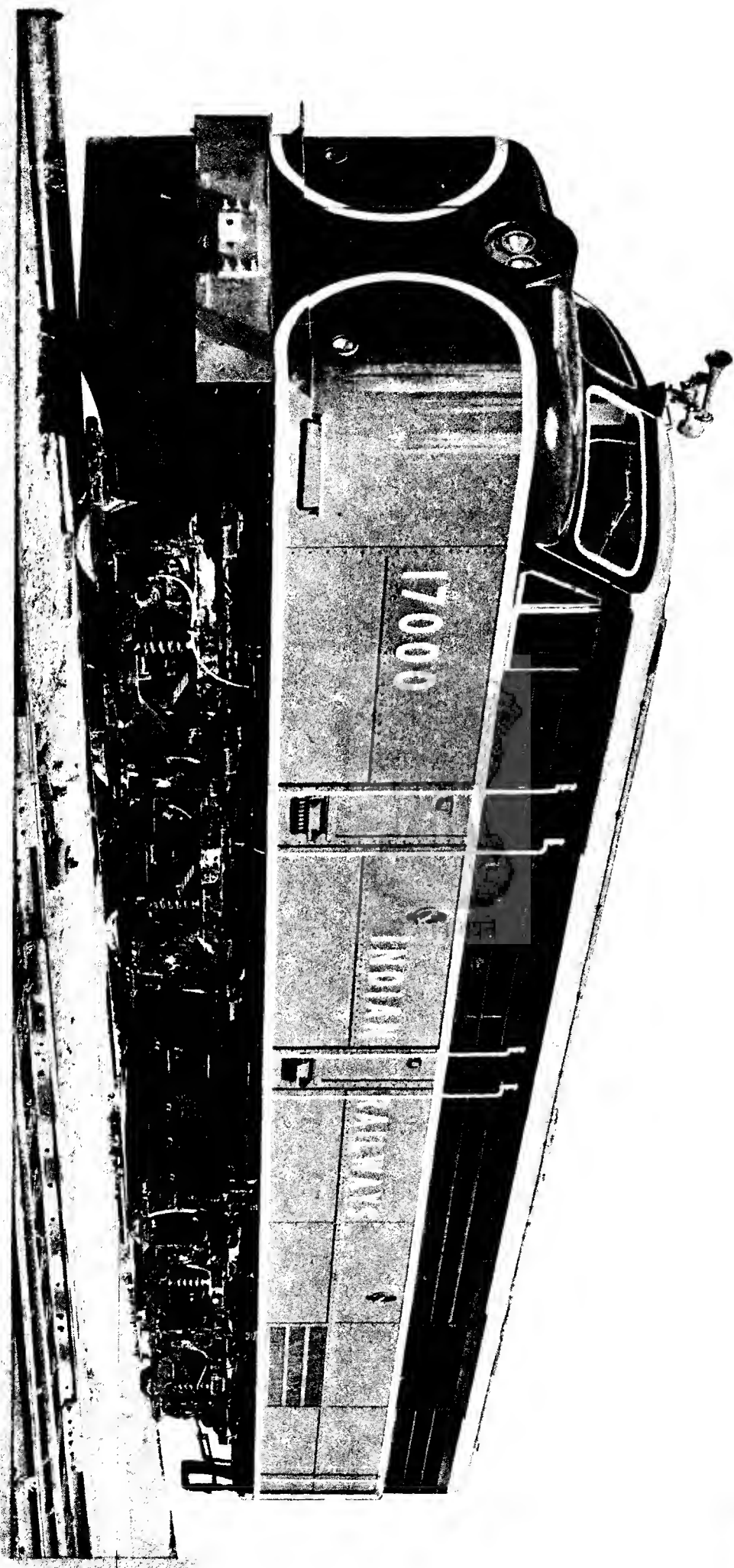
PROSPECTS OF FUTURE SUPPLIES OF COAL TO RAILWAYS
AND MEASURES NECESSARY FOR MEETING
DEFICIENCIES

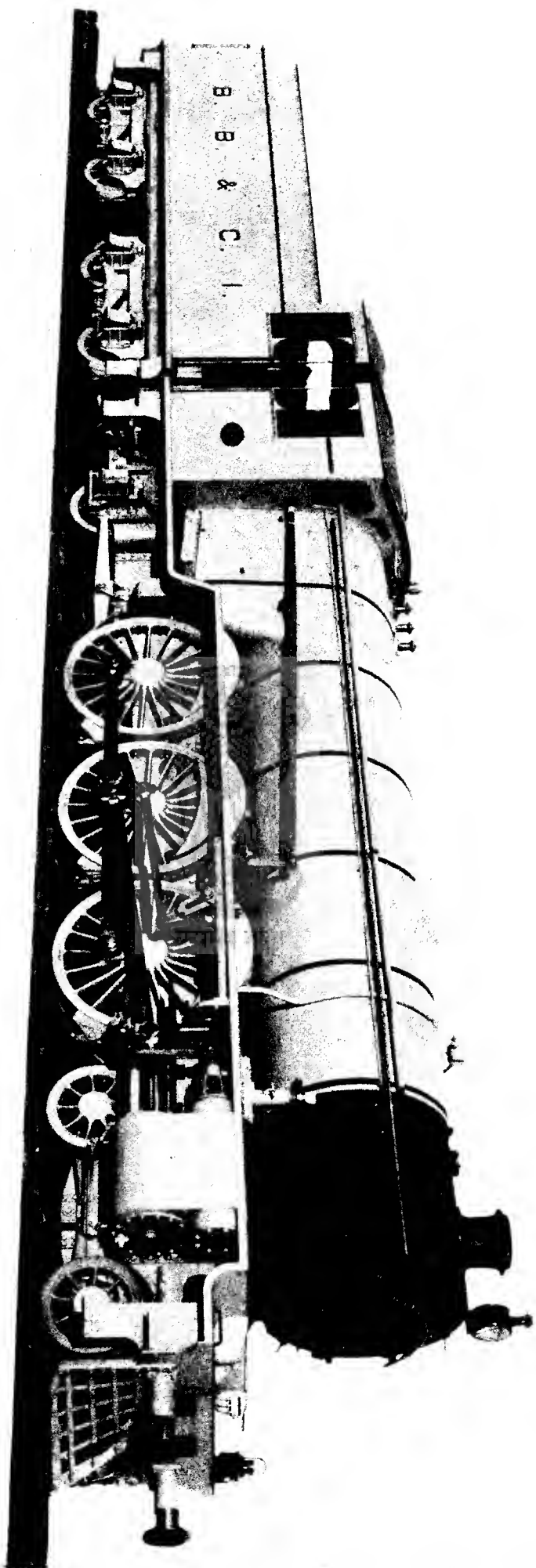
सत्यमेव जयते

400 H.P. DIESEL SHUNTING LOCOMOTIVE



1800 H.P. - DIESEL ELECTRIC LOCOMOTIVE



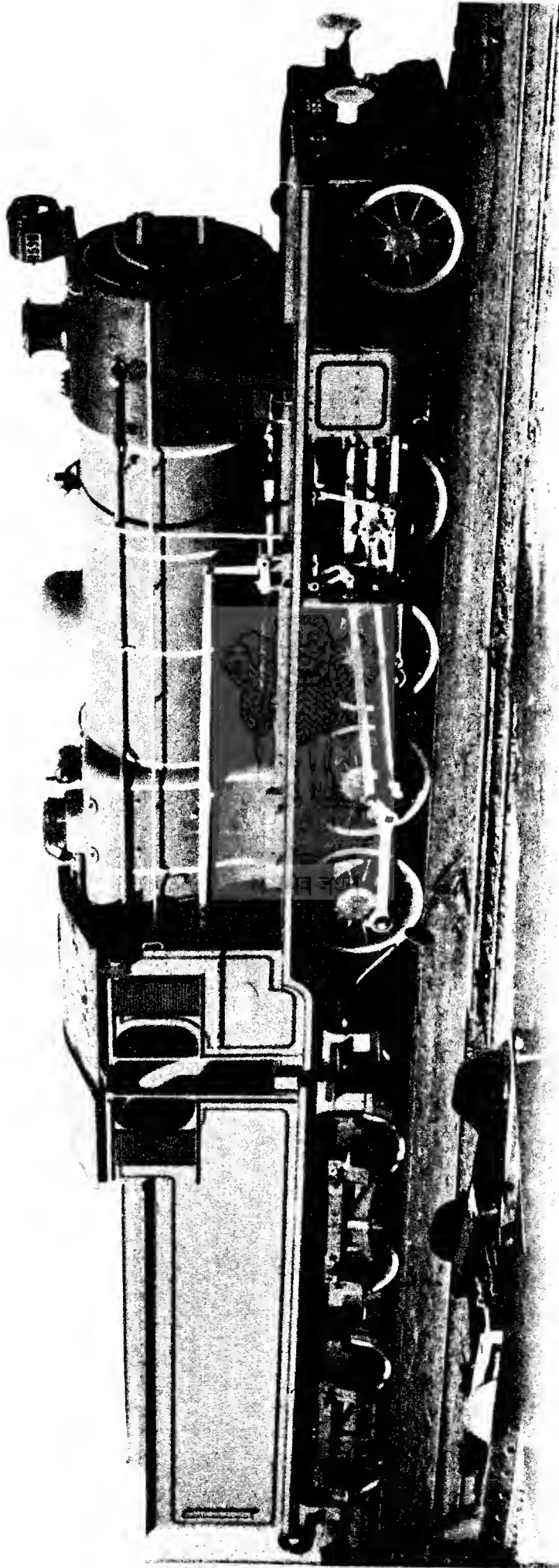


FIRE BOX PROPORTIONS

Grate Area	51 Sq. Ft.	Furnace Volume	272 C. Ft.
Fire Box Heating Surface	229 Sq. Ft.	Fire Box Heating Surface per Sq. Ft. of Grate Area	4.5 Sq. Ft.
Furnace Volume per Sq. Ft. of Grate Area	5.3 C. Ft.		

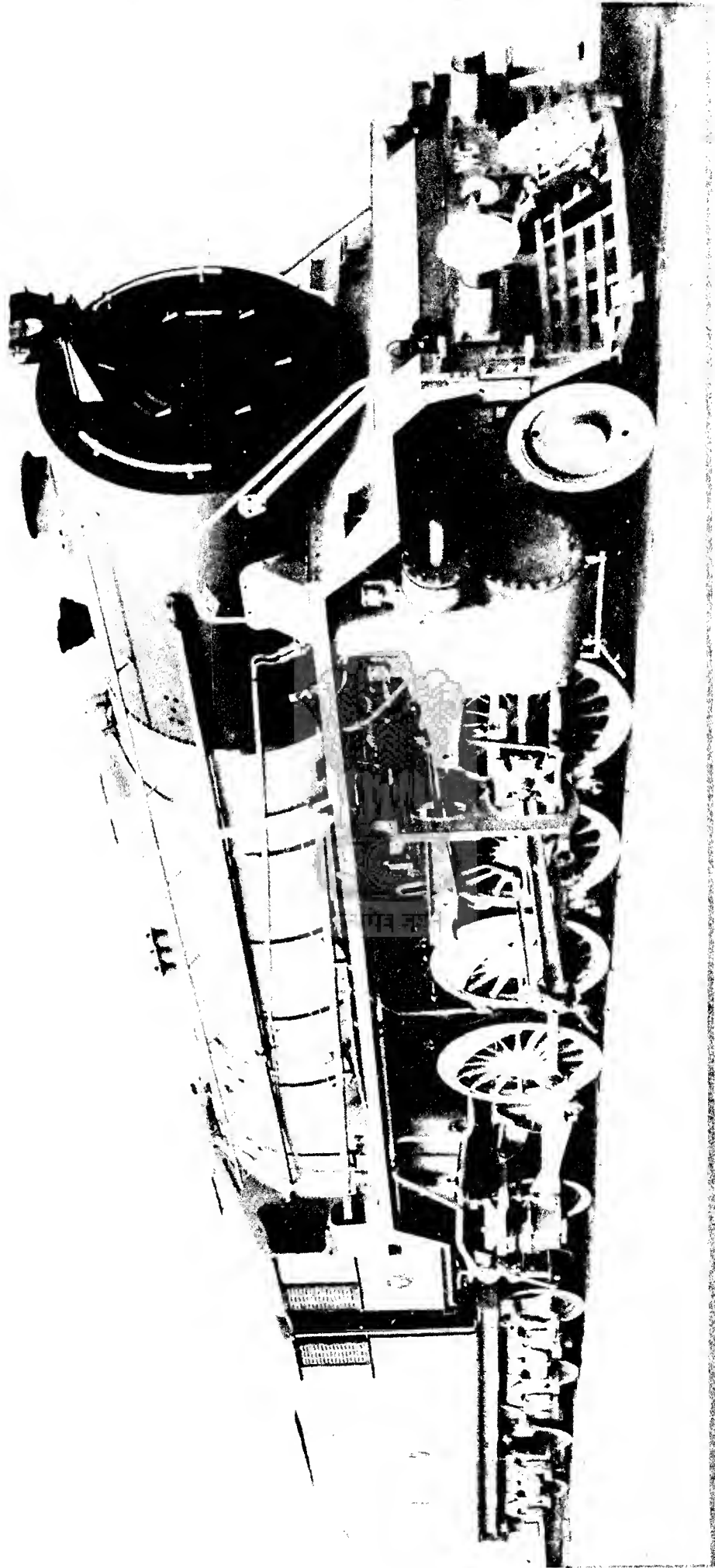
BESA GOODS LOCOMOTIVE (HGS)

PLATE 1



FIRE BOX PROPORTIONS

Grate Area	32.34 Sq. Ft.	Furnace Volume	193 C. Ft.
Fire Box Heating Surface	172.54 Sq. Ft.	Fire Box Heating Surface per Sq. Ft. of Grate Area	5.4 Sq. Ft.
Furnace Volume per Sq. Ft. of Grate Area	6.0 C. Ft.		

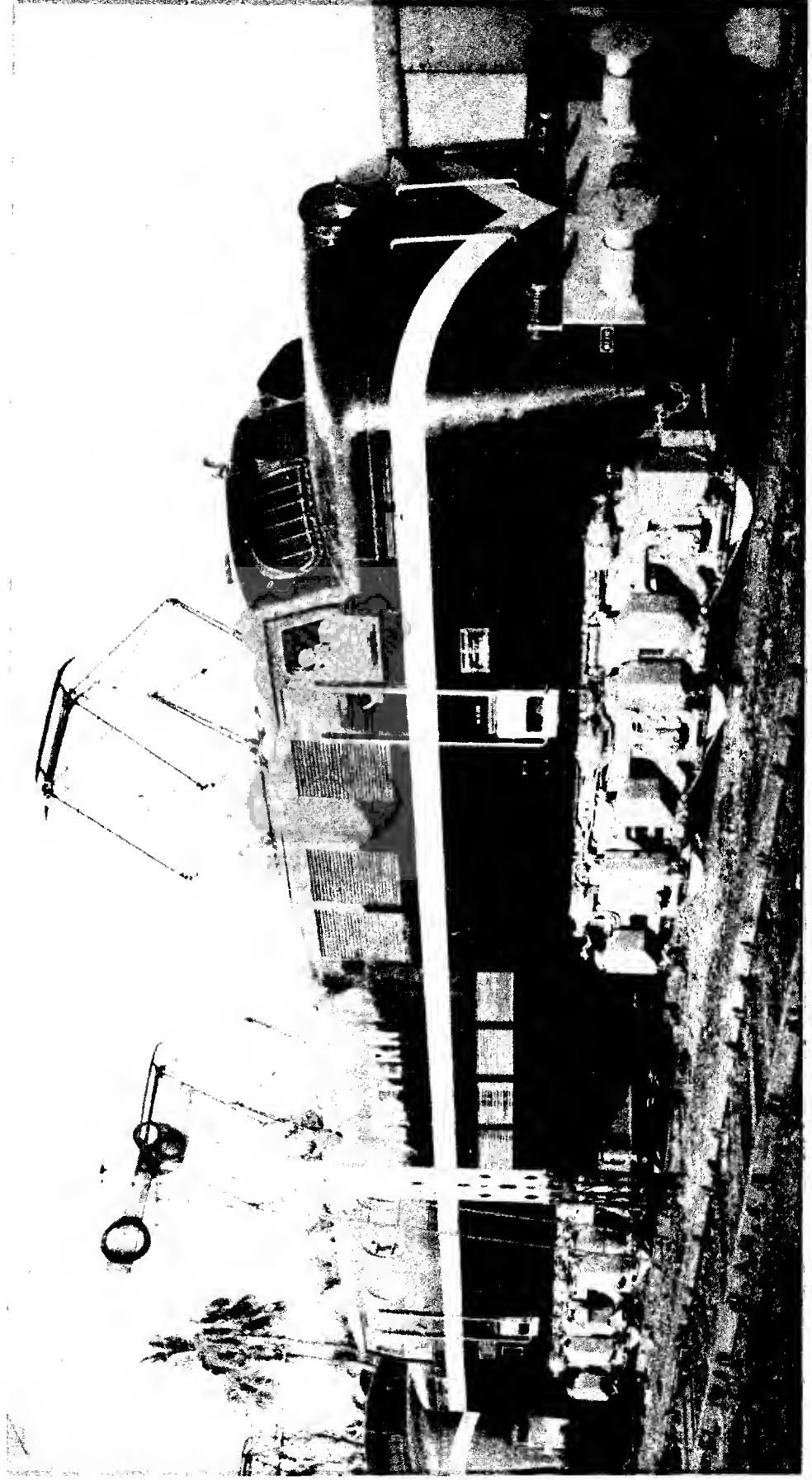


FIRE BOX PROPORTIONS

Grate Area	46 Sq. Ft.	Furnace Volume	338 C. Ft.
Fire Box Heating Surface	272 Sq. Ft.	Fire Box Heating Surface per Sq. Ft. of Grate Area	5.9 Sq. Ft.
Furnace Volume per Sq. Ft. of Grate Area	7.4 C. Ft.		

3000 H.P. ELECTRIC LOCOMOTIVE (3000 VOLT D.C.)

PLATE 6



3600 H.P. ELECTRIC LOCOMOTIVE (1400 VOLT D.C.)

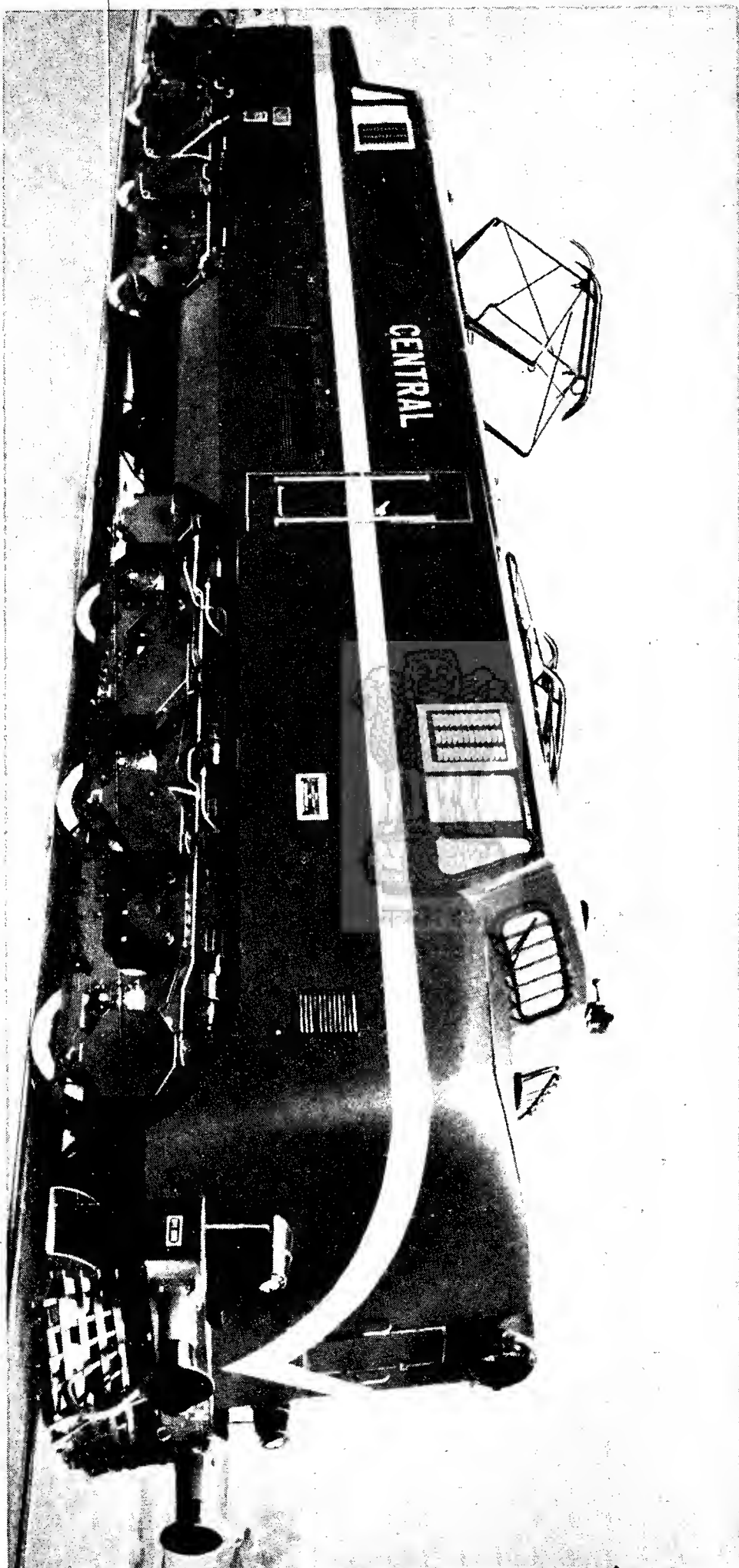
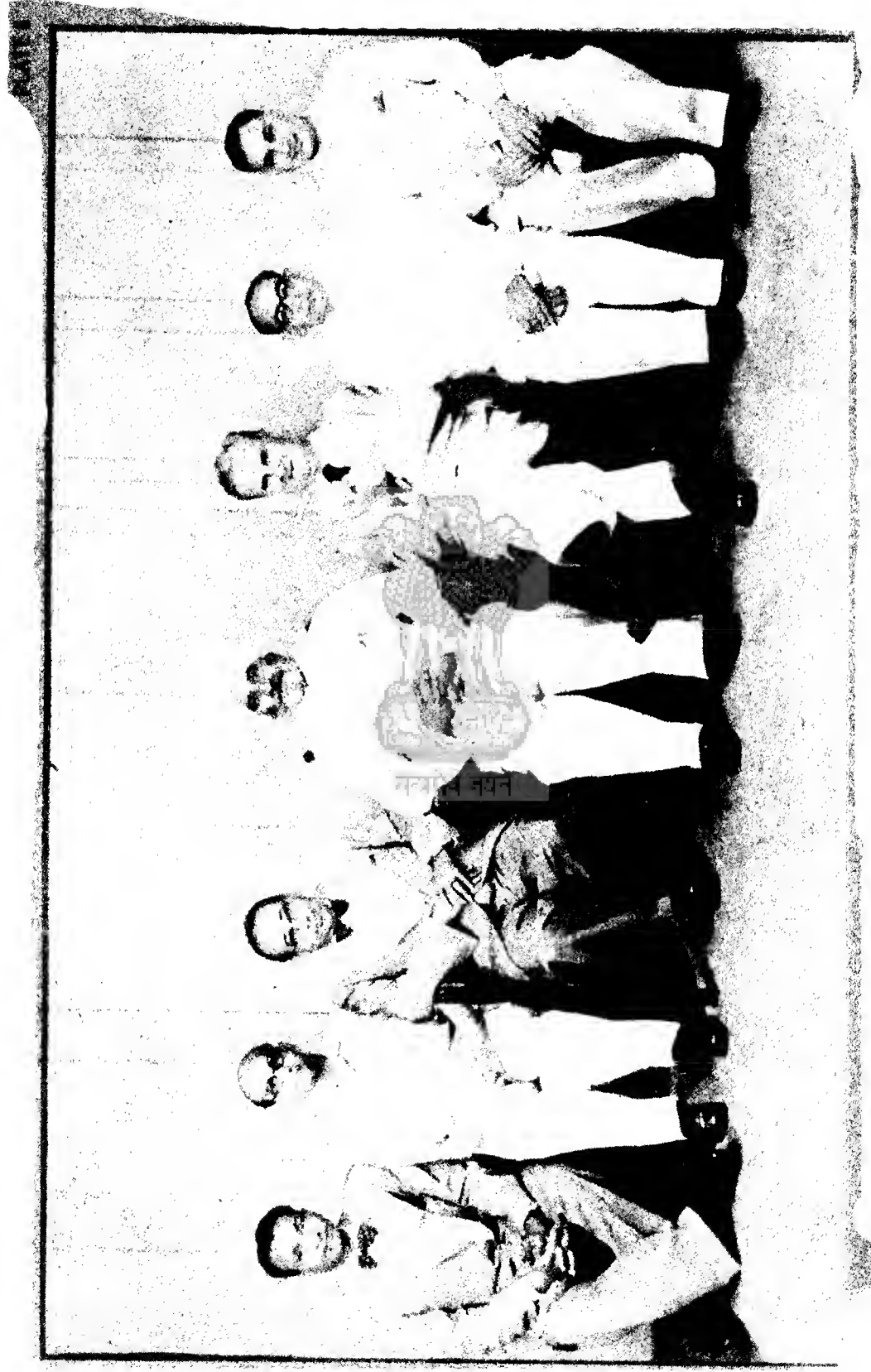


PLATE 7

THE EXPERT COMMITTEE



Left to Right: Shri R. Krishnaaswamy, Shri P. M. Nayak, Dr. A. Lahiri, Shri K. R. Narayana Murthy, Shri D. P. Mookherjee, Shri J. V. Whitehead, Shri K. R. Narayana Murthy.